

TRANSACTIONS
—OF THE—
♦ American ♦
FISHERIES SOCIETY

SIXTEENTH ANNUAL MEETING.

HELD AT THE
NATIONAL MUSEUM, WASHINGTON, D. C.

MAY 31ST, AND JUNE 1ST, 1887.



New York.

1887.

OFFICERS FOR 1887-8.

PRESIDENT.	W. L. MAY,	-	-	<i>Fremont, Neb.</i>
VICE-PRESIDENT.	H. H. CARY,	-	-	<i>Atlanta, Ga.</i>
REC. SECRETARY.	FRED MATHER.			<i>Cold Spring Harbor, N. Y.</i>
COR. SECRETARY.	W. A. BUTLER, JR.	-		<i>Detroit, Mich.</i>
TREASURER.	E. G. BLACKFORD.	-		<i>Brooklyn, N. Y.</i>

EXECUTIVE COMMITTEE.

CALVERT SPENSLEY, <i>Chairman.</i>	-	<i>Mineral Point, Wis.</i>
J. H. BISSELL.	-	<i>Detroit, Mich.</i>
DR. R. O. SWEENEY		<i>St. Paul, Minn.</i>
DR. W. M. HUDSON		<i>Hartford, Conn.</i>
LIVINGSTON STOR		<i>Charlestown, N. H.</i>
COL. M. McDONALD		<i>Berryville, Va.</i>
FRANK N. CLARK.		<i>Northville, Mich.</i>

CONSTITUTION.

ARTICLE I.—NAME AND OBJECTS.

The name of this Society shall be "The American Fisheries Society." Its object shall be to promote the cause of fish-culture; to gather and diffuse information bearing upon its practical success, and upon all matters relating to the fisheries; the uniting and encouraging of the interests of fish-culture and the fisheries; and the treatment of all questions regarding fish, of a scientific and economic character.

ARTICLE II.—MEMBERS.

Any person shall, upon a two-thirds vote and the payment of three dollars, become a member of this Society. In case members do not pay their fees, which shall be three dollars per year, after the first year, and are delinquent for two years, they shall be notified by the Treasurer, and if the amount due is not paid within a month thereafter, they shall be, without further notice, dropped from the roll of membership. Any person can be made an honorary or a corresponding member upon a two-thirds vote of the members present at any regular meeting.

ARTICLE III.—OFFICERS.

The officers of this Society shall be a President and a Vice-President, who shall be ineligible for election to the same office until a year after the expiration of their terms, a Corresponding Secretary, a Recording

Secretary, a Treasurer, and an Executive Committee of seven, which, with the officers before named, shall form a council and transact such business as may be necessary when the Society is not in session—four to constitute a quorum.

ARTICLE IV.—MEETINGS.

The regular meeting of the Society shall be held once a year, the time and place being decided upon at the previous meeting, or in default of such action, by the Executive Committee.

ARTICLE V.—CHANGING THE CONSTITUTION.

The Constitution of the Society may be amended, altered or repealed, by a two-thirds vote of the members present at any regular meeting, provided, at least fifteen members are present at said meeting.



SIXTEENTH ANNUAL MEETING

—OF THE—

AMERICAN FISHERIES SOCIETY.

FIRST DAY.

The Sixteenth Annual Meeting of the Society was held in the lecture room of the National Museum, at Washington, D. C., on Tuesday, May 31st, and Wednesday, June 1st. In the absence of Dr. W. M. Hudson, President of the Society, Vice-President W. L. May called the meeting to order at 11 A. M. on Tuesday, and after a short address the meeting adjourned until 3 o'clock in the afternoon.

On assembling again the following new members were elected: M. B. Hill, Clayton, N. Y.; Calvert Spensley, Mineral Point, Wis.; Walter D. Marks, Paris, Mich. The following were elected corresponding members: K. Ito, Hokkaido, Cho, Sapporo, Japan, member of the Fisheries Department of Hokkaido, and President of the Fisheries Society; W. Oldham Chambers, Esq., Secretary National Fish-Culture Association, South Kensington, London.

Dr. H. H. Cary said he had recently been examining oysters on the coast of Georgia with a view to planting in Lake Worth, Fla. The lake is situated on the east coast in one of the southern counties, near Jupiter Inlet, and is twenty-three miles long. It was once a fresh water lake, separated from the ocean by a barrier of coquina formation; but the inlet has been cut for the transportation of boats of ten tons or more, and now the lake is partially salt. The temperature of the Gulf Stream is not far

from 79 degrees Fahrenheit, and the lake is about the same. The question now arises, is this temperature too high for the breeding of oysters? The average depth of the lake is eight feet, and the bottom of the south end is muddy; other parts have hard bottom.

MR. WHITTAKER.—What is the temperature of the Indian River?

DR. CARY.—I think it is lower. The Gulf Stream diverges almost northeast, and the inlet to the lake is ten miles south of Jupiter Inlet. I believe that Mr. Mather has had some experience in raising oysters, and perhaps he can give us some information on this point.

MR. MATHER.—My experience has not been extensive enough to say at what temperature the eggs of the oyster will decline to hatch or the young will die. In 1885 Prof. Henry J. Rice came to Cold Spring Harbor to make some experiments in the propagation of oysters, and I loaned him a large wooden tank, in which he placed some young oysters immediately after hatching. The tank was put on the south side of the hatchery, and was fed by a stream of salt water not larger than a lead pencil; it was exposed to the sun and the water attained a temperature of 90 degrees, and no result was obtained. The next year I continued the experiments in the same tank placed on the north side of the building, with a temperature never exceeding 80 degrees, fair results being attained. How much higher a temperature they would have stood, I have no means of knowing.

DR. CARY.—I can place layers of shells on the bottom for catching the spawn, but there is a great deal of moving sand, and I would like to know if this would be injurious to the young oysters.

MR. EARLE.—No doubt moving sands would be injurious to the young oysters, because the shells to which they were attached would be buried and the young would be mothered.

DR. CARY.—There are oysters in Indian River, but it has been

a question whether there would be food in Lake Worth, the kind that oysters feed upon.

MR. MATHER.—The oyster feeds mainly upon diatoms, and attains a size in proportion to the food it gets. Some of the best feeding grounds on Long Island are in the brackish waters of the bays.

MR. EARLL.—While I don't know the limit of temperature at which oysters will spawn, I will say that I have found adults in water 84 degrees, and at 80 they spawn readily, Chesapeake Bay being 80 deg. every summer. Chrisfield, near Pokomoke Sound, and Tangiers Sound, famous oyster places, are often 80 to 85 degrees, and oysters spawn there in June and July.

The Secretary then read a paper by Prof. W. O. Atwater, entitled "Chemical Changes Produced in Oysters in Floating and their Effect upon the Nutritive Value." The meeting then adjourned until the following day.

SECOND DAY.

The meeting was called to order at 11:30 A. M. A telegram from Treasurer Blackford, stating his inability to attend, was read. The committee, consisting of Messrs. Whittaker, Spensley, Cary, Nevin and Earll, appointed on the previous day to nominate officers, made the following report:

For President.—W. L. May, Nebraska.

For Vice-President.—H. H. Cary, Georgia.

For Recording Secretary.—Fred Mather, New York.

For Corresponding Secretary.—W. A. Butler, Jr., Michigan.

For Treasurer.—E. G. Blackford, New York.

Executive Committee.—Calvert Spensley, chairman, Wisconsin; J. H. Bissell, Michigan; Dr. R. O. Sweeney, Minnesota; Dr. W. M. Hudson, Connecticut; Livingston Stone, New Hamp-

shire; Col. McDonald, Virginia; Frank N. Clark, Michigan; and upon vote these officers were declared duly elected.

The following paper was then read:

WORK AT COLD SPRING HARBOR.

BY FRED MATHER.

The past season has been the most successful one we have had since operations were begun here in 1883. We have turned out more fish than ever before, the figures for 1886 footing up to over 6,000,000; while this year the figures are over 9,000,000. There was a decrease in the numbers of salmon hatched and planted; also in trout, but an increase in shad and Adirondack frostfish and other species.

SALMON.—We received 300,000 eggs from the United States station on the Penobscot River, which hatched in such excellent condition that our loss was only about 8,000, which is the best we have ever done; of these fish 50,000 were planted in the Housatonic River, near Kent, New Milford and Falls Village, Conn.; 50,000 were placed in the Salmon River, near Albion, Oswego County, N. Y., and the remainder were placed in the smaller trout streams on the Upper Hudson, near North Creek, Warren County, N. Y., the terminus of the Adirondack Railroad. Mr. J. W. Burdick, General Passenger Agent of the D. and H. Canal Co., at Albany, very kindly gave us free transportation for cans and men to Albany, and Mr. C. E. Durkee, Superintendent of the Adirondack Railroad, offered us the same facilities over his road. Very encouraging accounts of our plantings of salmon in the Hudson are continually coming in. Last year over fifty were taken by different persons, and this year we are hearing of captures every day. A letter from Judge Danaher, of Albany, says that some of the fish have gone above the dam at Troy, and it is to be hoped that fishways will be placed there this year, a bill for that purpose being now before the New York Legislature. One salmon of 28½ lbs. has been taken this spring,

just below the dam at Troy, the largest fish of which we have any record of being captured in the Hudson. It has been proved conclusively that the Hudson can be made a salmon river. A bill introduced into the Legislature by Mr. Collins, which provides that no person shall at any time catch salmon in the waters of the State of New York with any device, save that of angling with line or rod, held in the hand, and then only from March 1st to August 15th in each year, passed both Houses and is now in the hands of the Governor.

LANDLOCKED SALMON.—From 40,000 eggs received from the United States station at Grand Lake Stream, it was decided to plant 25,000 in the tributaries of the Hudson River, and the majority of the fish were sent to Mr. A. N. Cheney, of Glens Falls, who placed them in Clendon Brook, a trout stream where the sea salmon have done well for several years, while the remainder of the fry were planted in Long Island waters.

BROOK TROUT.—We have received 90,000 eggs from the New York station at Caledonia, and from these and eggs which we took from our limited number of stock fish, we have distributed in waters in the State 148,986 fish and fry, and we may say that in all cases where the numbers are given there is no guess work about it. The eggs are counted in a measure, and the rest are measured in the same glass; then when they are placed in the hatching troughs an account is kept of the number of dead eggs and fry taken from each trough, so that we can tell exactly how many fish there should be remaining in each compartment.

BROWN TROUT.—We received several consignments of the brown trout, *Salmo fario*, the common brook trout of Europe, from the Deutschen Fischerei Verein, and also from Herr Max von dem Borne, the well-known fishculturist of Berneuchen. These were on account of the United States Fish Commission, and some of the eggs were sent to Michigan, Pennsylvania, Virginia and Washington. We hatched and distributed 34,000.

LOCH LEVEN TROUT (*Salmo leuvenensis*).—The eggs of this famous Scotch trout were sent to us by James Gibson Maitland, Esq., proprietor of the Howietown Fishery at Sterling, Scotland; 24,000 fry were produced from the eggs.

RAINBOW TROUT.—From 10,000 eggs sent us from the New York station, Caledonia, we have 8,000 strong, healthy fry.

SAIBLING (*Salmo salvelinus*).—This handsome trout, which is a native of the cool lakes of Germany and Bavaria, and attains a large size, being one of the chars, is a very brilliant fish. I have seen a specimen of 5 lbs., a male in breeding dress, in October, which was a brilliant crimson up to and above the lateral line. The eggs of this fish were distributed by the order of the United States Fish Commissioner in several States, some going to Virginia, Michigan and Pennsylvania. We sent some fry to Mr. Cheney for Lake George, and have retained some for breeders.

WHITEFISH.—From 1,000,000 eggs received from the United States station at Northville, Mich., we have planted in Dutchess County, N. Y., and on Long Island, over 900,000 fry.

FROSTFISH (*Prosopium quadrilateralis*).—This fish, which is found in the Adirondacks, where in Chateaugay Lake it is called "Shad," while in Maine and perhaps other places it is variously known as frost-fish, shad-waiter, etc. We received some 250,000 eggs from the New York station at Lake Brandon, and planted 200,000 fry in Dutchess County, N. Y.

GRAYLING.—From 10,000 eggs sent to Mr. Blackford from France, we first thought we could not save a fish, but we hatched and brought to the point of taking food 350 fry from these eggs. We placed these in a small pond of about 15 feet in diameter and 1½ feet deep, where there was a good flow of water, but we have never seen one of the fish since.

SUNAPEE TROUT.—From Mr. E. B. Hodge, of the New Hampshire Commission, we received 10,000 eggs of the large trout recently discovered there; it is of the Oquassa type, concerning which there has been considerable dispute as to its species. We hatched 3,000 fry which seemed strong and healthy, which we placed in a pond similarly described for the grayling, but we have never been able to see them since.

WHITE PERCH.—We obtained some eggs of these fish from St. John's Lake, near the hatchery, and we also took some by hand from the fish; in all about 10,000 eggs. The eggs are ad-

hesive, and when laid by the fish are scattered similar to those of the carp. The fry are the smallest of any that I have hatched, and it requires a second look to see them in a small glass aquarium. We tried to retain a few, but we were not successful, as they died shortly after the absorbing of the sac.

SMELOTS.—Out of over 4,000,000 eggs we hatched and planted 2,000,000, or about 50 per cent., which is as good as we have ever done. I have on two former occasions read papers on the hatching of the fish before your honorable body, and have nothing new to add. The little smelt carries a great many eggs for its size; from 30,000 to 60,000, or perhaps more, and from 100 ripe females of good size, probably 5,000,000 could be obtained.

SHAD.—We received from the United States Commission at Washington, over 5,000,000 eggs taken on the Potomac River, packed there and sent to Cold Spring Harbor. From this lot we hatched 2,000,000 fry, the last lot of eggs being a total loss; perhaps, because they remained in New York a day and were placed in a refrigerator, for the shad egg will not bear the chilling changes necessary to preserve the eggs of salmon or trout. Of the fry obtained, 800,000 were placed in the Hudson River at Albany, and 1,200,000 in Long Island streams, shipments being made to the Nissequogue River, at Smithtown, on the north shore of Long Island, and to the Connetquot River, emptying into the Great South Bay; the planting in the latter river was made at Bridge Hampton. The weather was very favorable for hatching, and we used only spring water for them, and at no time the temperature of the water fell below fifty-nine degrees.

Last winter was the third winter we hatched the little tomcod and we turned out 3,400,000 in the harbor. This little fish, although not in great demand in the markets, forms an important item in the food supply of the inhabitants of Long Island, especially on the north side, as the boys catch them by hundreds and sell them to people in the vicinity. Shortly after we began our hatching operations and paid some attention to this fish. Cold Spring, Huntington and Oyster Bay harbors have been literally swarming with little tomcods, which are all credited by the people here to our hatching operations. We made no attempt

to hatch codfish, because of the condition of our hatchery, in which we could not keep the salt water pipes from freezing; but if we get a new building, as we expect, we will no doubt be able to proceed with the hatching of the cod, as has been done at Wood's Holl. Last winter, when every salt water pipe froze, we had a portion of our tomcod eggs in jars, and as salt water was not available we tried fresh water; and after hatching them in fresh water, we kept a large number in fresh water until they were ready to take food. No doubt this little fish could be acclimatized in the Great Lakes, and if not valued for food, would be desirable as food for the other fishes; but on Long Island the tomcod is regarded as a very desirable fish, and they are taken from all sizes up to perhaps $1\frac{1}{2}$ lbs., which is the largest I have ever seen. They resemble the common cod in having three dorsal and two anal fins.

The following table gives a summary of this year's work:

Penobscot salmon planted in Hudson River.....	192,000
Penobscot salmon planted in Salmon River.....	50,000
Penobscot salmon planted in Housatonic River...	50,000
Landlocked salmon planted in Hudson River.....	25,000
Landlocked salmon planted in Hatchery Pond.....	12,000
Brook trout planted in State waters.....	148,986
Brown trout planted in State waters.....	34,000
Rainbow trout planted in State waters.....	8,000
Loch Leven trout planted in State waters....	24,000
Saibling planted in State waters.	5,000
Whitefish planted in State waters....	985,000
Tomcod planted in Cold Spring Harbor.....	3,400,000
Smelt planted in Cold Spring Harbor....	2,000,000
Shad planted in Hudson River and Long Island....	2,000,000
Frostfish (Adirondack).....	200,000
Grayling	350
Sunapee Lake, N. H., Oquassa trout	3,000
White Perch.	10,000

Cold Spring Harbor, N. Y.

9,157,336

COL. McDONALD.—So far, I have found no satisfaction in handling glutinous eggs, and the only real success I have met with was with the eggs of the white perch. We had collected some adult fish for Mr. Mather to send to Germany, and they were put in a perforated can in the river to keep for a few days, and on taking it out we found the side of the can coated with eggs, and sent it to the central station, hardly expecting any results, as we were not certain that the eggs were impregnated. In three or four days a large proportion of the eggs hatched; we had given them no attention at all, but simply left them alone. The eggs were evenly distributed on the can, and not hung in masses; now, perhaps as good a thing to do with glutinous eggs is to let them alone. The eggs of the yellow perch are laid in rows and hung over twigs and are merely suspended, where the eggs hatch without being disturbed. The catfish also lays glutinous eggs, but they are not stuck together; when the female lays them she leaves the male to hover over them. Now, it may be, that in all our attempts to hatch glutinous eggs we have only tried the same methods which we used in handling eggs which are non-adhesive, and have departed too far from nature in this matter.

MR. MATHER.—You will notice in my report I mention the fact that all the white perch which we tried to keep and feed died.

COL. McDONALD.—So did ours, and I would like to hear from Mr. Marks about the "jack-salmon," or pike-perch, and what success he has had in hatching the glutinous eggs of this fish.

MR. MARKS.—We have hatched them for the past two years, and always by separating the eggs, and never in any other way. Although it is a long and tedious process to break the adhesive character of the eggs, it is the only way we have ever succeeded. Mr. Nevin has a paper on the hatching of the fish, and I can only say that our method is the same as his. The eggs are taken in the rivers and transported to the hatchery on trays.

The Society then adjourned until 2 P. M.

At the opening of the afternoon session, the Secretary read the following paper:

HATCHING THE WALL-EYED PIKE.

BY JAMES NEVIN.

The eggs of the wall-eyed pike cause more trouble while undergoing the process of hatching, than those of any other of our better class of fish, owing to their great adhesiveness. If not attended to properly before being placed in the hatching jars, they will stick together in bunches and float off through the outlet from the jar; and should screens be used to prevent this, they will be blocked up and the eggs carried off with the overflow. In our Milwaukee hatchery we have been raising pike fry for the past three seasons, and after trying various plans to counteract this evil, I have found the following to answer most satisfactorily.

As soon as impregnated the eggs are placed in tubs or some such vessels, and kept in constant motion by gently stirring until they have become hard, usually about five hours after being taken from the fish. They are then placed on cotton flannel trays and shipped in boxes in the same manner as whitefish eggs. As soon as they are received at the hatchery they are put into tubs, each tub to be not more than three parts full of eggs; they are then gently stirred with the hand until thoroughly loosened or separated. Immediately alongside should be a screen about three inches deep, and with holes just large enough to allow the egg to pass through. This screen fits into a tub of clean water and the eggs are dipped into it, and by gently shaking the screen they all pass through. By this means we know that each egg is separated from those surrounding it. I then take some of the sediment from the bottoms of the supply tanks and mix thoroughly with the eggs. A certain amount of this sediment adheres to the eggs and prevents the "bunching" when placed in the jars. After carefully following this plan the eggs can be placed in the jars, and if given a sufficient current of water to keep them moving very gently, there will be no danger of their floating off; nor do they require continual watching for the first forty-eight hours, as in the old method.

They take from fifteen to thirty-five days to hatch, according to the temperature of the water; the colder the water the longer the time required. When the fry are seven or eight days old, the little fellows will begin eating one another, and hundreds of them can be seen swimming in the tanks, each with a fish in his mouth that seems as large as himself. A small percentage of loss can be put down to this cause. We usually ship 50,000 in a twelve-gallon can, and find it necessary to use ice to keep the temperature of the water sufficiently low for them to stand the journey.

If fifty per cent. of the eggs can be hatched it can be considered very fair success. My opinion is that the general average is lower, although one case that came under my notice very much exceeded this. In the instance I refer to, there were two small shipping boxes of eggs sent to a hatchery and fully 75 per cent. were dead before leaving the spawning grounds, and the man who took the eggs told me that the rest of them died when put in the jars, and there were no more pike eggs sent to that hatchery that season; yet, on reading the annual report for the same season's operations at that hatchery, I saw that ten millions of wall eyed pike fry had been distributed! Men claim that they can hatch 50, 75 and even 90 per cent. of the eggs of certain fish; but here is a case that calls for special attention — several hundred per cent. from dead eggs. Why each egg, even if dead, must have brought forth twins or triplets, at least. I think it would be a capital idea for all of us that are engaged in pike culture to get our eggs from that locality in the future, and we should work hard to get very stringent laws passed protecting the locality, so that such a very prolific and peculiar class of fish should not be killed or destroyed.

There is no doubt that such deception as this injuriously affects the science of fishculture. The people of the country on reading or hearing of certain waters being stocked with thousands or millions of fry, as the case may be, naturally look for some beneficial result in the near future; and when no such result shows itself, they are inclined to say that artificial propagation of fish is very much over-estimated, nor can we blame them.

During the season just passed we secured for our Milwaukee

hatchery about 30,000,000 wall-eyed pike eggs, estimating them at 120,000 to the quart measure, and though as fine a looking lot of eggs as one could wish to see, I do not expect to have more than 10,000,000 fry to distribute. These 10,000,000 will fill about one hundred of the applications we have on file, leaving nearly another hundred to be left over until next year.

The best breeding grounds in Wisconsin for this fish are Green Bay, and Fox River emptying into it. Last winter our Legislature passed a law preventing the killing, buying, selling or having in possession any wall-eyed pike from these waters weighing less than 1½ lbs. A similar law for protecting our whitefish in Lakes Michigan and Superior, and their bays, was passed, and I have no doubt that a very few years will prove the wisdom of these laws, as the fish will be enabled to reach an age and size that will make them useful as breeders, and valuable as commercial fish. The main trouble hitherto has been that our lake fish have been caught when weighing a pound, and even less; consequently they had no opportunity of being reproducers of their kind, and brought such a low price per pound that a fisherman could hardly make more than living expenses.

In conclusion, I will give a brief summary of the fry that have been turned out and the number of applications filled in 1887 up to the present time, by the Wisconsin Fish Commission :

	No. of applica- tions filled.	No. of fry planted
Brook trout	212	2,930,000
Mountain trout	119	1,350,000
Mackinaw, or lake trout.....	...	500,000
Whitefish.....	...	31,500,000
Wall-eyed pike	67	8,000,000
Total.....	398	44,280,000

Madison, Wisconsin.

By request, Mr. K. Ito, President of the Fisheries Society of Northern Japan, spoke on the Fishing Industries of his country, and his remarks were taken down by Mr. J. C. O'Connor, Secretary to Col. McDonald, of the United States Fish Commission. They were as follows :

THE FISHERIES OF JAPAN.

BY K. ITO.

Gentlemen: My intention in being present at this meeting is simply to benefit myself by gathering the crumbs that fall from your table, and not to benefit you by any talk, as I am not prepared to make any remarks; but at the same time I am very much interested in this society. I have heard and read so much about it while in my own country that it gives me great pleasure to be able to be present at this meeting, my great interest in which has prompted me to make the bold attempt of addressing you in a tongue with which I am not familiar.

Fish constitutes the chief article of food in Japan, and the fishing industries are necessarily the most important pursuit of the Japanese. It gives employment to 1,654,178 men, and yields \$35,000,000. The peculiar features of the country afford every kind of fishing, and a great many varieties of the marine animals and plants are collected and utilized. It is not possible, however, without some previous preparation, for me to enumerate them or to give any account of the methods used for catching and curing them. I will, therefore, limit my subject to the fisheries of Northern Japan, or Hokkaido, with which I am more familiar. Hokkaido, more familiarly known to you under the name of Yesso, is one of the islands constituting the Japanese Empire, and is situated between 40 deg. 21 min. and 45 deg. 30 min. north latitude. It covers an area of about 319,000 square miles. The fisheries industry is the oldest and most important of the island. I will give a brief description of some of the principal fisheries of the Hokkaido.

First in the order of importance are the spring herring fisheries. The spring herring (*Clupea harengus*) approaches the western coast of the island in tremendous groups in the spring and early summer, and fishing is carried on from the first part of April to the last of June. The implements used for the capture of this fish are of two kinds—the gill-net and the moored trap-net.

The fish caught are gutted, and the bones and head taken off and dried upon scaffoldings. They are then made into bundles and sent to the southern part of Japan for food, while the roes, which are left, are dried on the flake or pickled and used for food. The head bones and gills, left after making the boneless herring, are also dried and utilized as fertilizers. But since the introduction of traps, about thirty years ago, and also the introduction of the pocket attachment after that, the catch became so enormous that every fish caught could not be utilized in the old way, and so the guano and oil industries were inaugurated. This industry, has grown from year to year, and at present is the most important of the fisheries of the Hokkaido. At present the total amount of the dried scraps manufactured reaches the enormous quantity of ninety thousand tons.

Next in importance is the salmon fishery. Our salmon belongs to the same *genus* as the Pacific coast salmon. There are two principal species of salmon, namely, the spring salmon (*Oncorhynchus perryi*) and the fall salmon (*Oncorhynchus haberi*). The spring salmon ascend the waters for the purpose of spawning in the months of May and June, and the fall salmon in the late fall months. The fall run is the more numerous of the two but inferior in flavor.

The methods used in the capture of this fish are several, but the principal kinds of nets used are the drag-seines, traps and gill nets in the seas, while only the drag-seines are used in the rivers. Some of the chief salmon rivers in the island can still compare with any salmon rivers in this country. The most important river for salmon is Ishikari, emptying into Stroganof Bay, on the western coast. Curing in salt used to be the only way of preparing salmon for market, but about eight years ago the Government employed Mr. Treat, of Eastport, Me., to introduce the method of canning the fish, and the new industry is growing constantly, and some of the articles are now sent to France. About three years ago a gentleman commenced a smoking business there, and this we hope will soon become one of the principal industries in the salmon fisheries.

Now, I will make a few remarks on the cod fisheries. The cod are most abundant in the winter and early spring. The fish-

ing ground at present is limited more to the in-shore, being from five to twenty-five miles from the shore and in water of 100 or 200 fathoms deep. The gear used for capture is the trawl exclusively, the construction of which is on the same principle as the trawls used in the New England fisheries of this country. The vessel used in this work is very small. It is an open, flat bottomed boat, about 36 feet in length, and is furnished with a single mast and one large clumsy rectangular sail. The most common method of treating the cod is to take off the head and bones and dry them very hard, like the Norwegian stockfish. The second way is to split and thoroughly cure them with salt. Still, some of the fish of the early catch are just gutted, slightly cured and sent away for more immediate consumption.

Another important fishery is the iwashi (*Clupea melanosticta*), a kind of herring that comes into the open sandy beach of the eastern coast in the months of June and July. Their schools are not so large as those of the spring herring, and are sometimes mixed with "seven dots" (*Etrumeus micropus*) and also with the young of the spring herring. The principal contrivance for the capture of this species is the drag-seine. The fish are all made into scrap and oil.

Next, I will mention the trepang fisheries. Trepangs, or sea-cucumbers, occur in the sandy bottom of the sea all along the coast, and are gathered by the use of a dredge. The fish caught are gutted and boiled in a decoction of mugglewolts or artemisia, and are then spread on a sort of cleat with bamboo bottom, and dried for exportation to the Chinese market.

Another fish for the Chinese market and of great importance, is the awabi. The awabi is a gigantic gasteropod, which is known on the Pacific coast of this country as "abalone." It is speared from an open boat just like the dories used by the New England cod fishermen, in water from two to four and a half fathoms deep. The fishermen formerly used cod oil in order to look into the bottom of this deep water, but water glass is now almost universally used for this purpose. About five years ago some adventurous fisherman introduced the diving apparatus, but in consequence of its injurious effect upon the propagation of the shellfish it was finally prohibited by legislation. The

fresh product of this fish is separated from the shell, cooked, slightly smoked and dried, and then sent to the Chinese market.

Next comes the squid. The squid, which has its run in the fall, lives in big schools and is caught with the jig. It is split open, pressed and dried, and sent over to China.

Another product of the sea I would like to mention is the kombu. The kombu is a kind of algæ belonging to the species of *Laminaria*. They occur in great abundance all along the coast, but the best kind is obtained on the northeastern coast, where the cold current comes down from the north. They are taken from the rock upon which they grow by the use of the wooden hook; they are then dried on the sandy beach, made into bundles and exported to China.

Now, let me say a few words in reference to the fishermen on the island. They are divided into three classes: First, outfitters; second, fishery proprietors; and third, employees. Outfitters are those who furnish the fishing gears, or capital or food supply to the fishermen who cannot fit out for themselves; the fishery proprietors are those who own the fishing vessels, fish houses and all fishing gears, and the employees are those employed by the fishery proprietors for the prosecution of the fisheries. Some of the fishing is done on shares, like the cod fishery of this country, while others are part in shares and part in wages, and in some cases certain parts of the entire catch are given to the gang of employees, besides regular wages.

The fishermen of my country are a most open-hearted and frank set of people, and are sometimes superstitious. Among the fishery proprietors there are a great many well educated, intelligent and progressive men. They have formed associations there for the purpose of preventing the manufacture of inferior articles and to adjust any disputes arising between fishermen. They have a fishery society there under the name of Hokusui Kyokwai, for the promotion and improvement of the fisheries. They publish monthly reports and distribute among the fishermen important and useful information in regard to the fisheries. They also publish the translated account of valuable information from this country. I think it will be of some interest to you to know that a recent number of a publication which I have

received contains a translation of the paper read before the Fishery Convention in London, by one of your prominent members, Prof. Goode. This society holds fairs for competing in the kind of articles manufactured by the different fishermen.

Now, I will say a few words in regard to the measures adopted by the Government for the promotion of the fisheries on the island. Under this head there are only a few laws for the protection of salmon. The principal feature of the legislation protecting salmon is that no stationary apparatus is allowed in the river, and the only kind of net allowed is the drag-seine. The next feature is that all nets must be taken out of the water from sunset to sunrise, that is, every night they must cease fishing. The next prominent feature is that fishing of any kind is prohibited in the spawning tributaries; and during the spawning season the Government appoints fish wardens to protect the fisheries from the poachers. In addition to this legislation in regard to salmon, there is also a law, which I have already mentioned, against the use of diving apparatus for the capture of the awabis.

Next, let me refer to the measures adopted for encouraging the fishermen. The Government has a fund which is loaned to the fishermen when they meet a bad season, and when they cannot borrow the capital to furnish their outfit. The Government also exempts for a certain length of time from the fishery tax all those fishermen who open new fishing grounds or who make new fishing establishments wherever it is impossible to make them without the expenditure of large sums of money.

Lastly, let me just touch on the legislation for regulating the fisheries. Under this head I may mention the method which has been adopted by the Government to govern all fishing grounds. In every fishing locality the position of all traps and seines is located on a map, and this map is filed in the county offices for the reference of fishermen, so that when they have any quarrel in regard to the position of nets it can be settled very easily. Under this head comes the regulation for inspecting the manufacture of "kombu." The manufacture of "kombu" lately became inferior, and to check this evil the Government has made a regulation requiring that all kinds of kombu must be inspected

and branded before it is exported, just as the mackerel are branded in this country.

Now, before I finish my remarks, let me read a few statistics concerning the fisheries of the island, which I prepared some time ago for the United States Fish Commission Bulletin :

NUMBER OF PERSONS, BOATS, SEINES AND NETS ENGAGED IN THE FISHERIES OF HOKKAIDO IN 1884.

	Hakodate district.	Sapporo district.	Nemuro district.	Total.
Fisheries propriet'rs	3,218	3,324	1,338	7,880
Employed hands...	17,440	33,630	14,703	65,773
Boats	15,100	16,800	3,473	35,373
Seines	496	267	326	1,089
Trap-nets	935	1,828	335	3,098
Gill-nets	150,820	33,365	65	184,250
Miscellaneous nets..	6,406	40	65	6,511

VALUE OF THE PRINCIPAL FISHERY PRODUCTS OF HOKKAIDO IN 1884.

Fishery.	Hakodate district.	Sapporo district.	Nemuro district.	Total.
	Yens.*	Yens.	Yens.	Yens.
Herring	1,412,762	2,023,883	108,003	3,544,648
Fall salmon	31,389	221,993	281,874	535,856
Spring salmon	1,528	5,617	118,675	125,820
Cod	16,396	85,048	712	102,156
Iwashi	116,577	15,434	1,640	133,651
Trepang	5,661	23,210	14,623	43,494
Ear-shell	26,818	95,123	.....	121,941
Squid	35,250	2,817	.....	38,067
Kombu	49,993	189,811	164,440	404,244
Sea-otter .....	.....	.....	3,150	3,150
Oyster .....	.....	.....	13,413	13,413
Total	1,696,974	2,662,936	706,530	5,066,440

*One yen equals about 80 cents.

I will remark here, however, that the figures just given are rather smaller than the average, on account of the poor catch and low prices during the year; but I think they will give an idea of the amount of the fish caught on the island.

At the conclusion of Mr. Ito's remarks, a vote of thanks was accorded him for his very interesting statements of the fisheries of a country of which we know so little, but which has made such rapid strides in acquiring the knowledge possessed by what a few years ago was an outside world to it. It is interesting to note, how closely all foreign methods have been copied by these exceedingly intelligent people, as soon as their ports had been opened to the world.

Mr. Earll then made the following remarks upon the changes and conditions of fish-culture, and the duties of fish commissioners under the new conditions, which were also taken down by Mr. O'Connor.

STATE FISH COMMISSIONERS.

BY R. EDWARD EARLL.

Mr. President—I do not intend to occupy the time of the Society with a paper, but it has occurred to me that this would be an excellent opportunity to bring to the attention of its members a matter, the importance of which, has been growing upon me for some time, namely: the changed condition of the duties of Commissioners of Fisheries. During the past few years it has been the one great and sole aim of all the Commissioners to hatch out and plant in the waters of their respective States as many fish of the different kinds as it was possible for them to hatch and distribute, with the means placed at their disposal; but we find that the time is rapidly approaching when it will become necessary for the officials to present to their respective governments, or to the appropriation committees of said governments, a clear and concise statement of all that is being accomplished with the money appropriated for fish-cultural work.

There has thus far been very little effort on the part of most of the States, and until recently upon the part of the general government, to obtain definite and detailed information regarding the extent and value of the fisheries of the various localities. It is, in my judgment, especially important that each Commissioner

of Fisheries should make himself, as far as possible, thoroughly familiar with the details of the fisheries of his own State. I say the fisheries, I mean more especially the commercial fisheries—that he should give special attention to the kinds of apparatus that are being introduced into the waters, and to the effect of each particular kind of apparatus upon the abundance of fish. It is only by this means that he will be enabled to tell what the result of his labors in stocking the waters is proving to be; and, further, it is only by this means that he will be enabled to stand between the man who condemns all fishing for profit and the man who wants no restrictions placed upon the fisheries. We have at the present time two contending parties—on the one hand, the angler, who wants fishing only for sport, and wishes to prohibit the use of every form of implement for catching fish that will interfere with the enjoyment of his summer vacation; and on the other hand, a large class of men who derive their entire support from the catching of fish for market. Each class comes with its complaints to the legislative bodies of the country, and the one that makes the best impression upon the legislature is very apt to carry the day. We are thus coming to have a series of laws enacted, some of which are very unwise and ought never to appear upon the statute books.

It is only recently that the U. S. Fish Commission has undertaken to familiarize itself with the details of the fisheries. Through an arrangement with the Census Office in 1879, Professor Baird, as you all know, was allowed an opportunity of carrying out an elaborate scheme for the investigation of the commercial fisheries. The work was placed under the direction of Prof. Goode, and the results of that work are beginning to appear. Owing to the exhaustion of the appropriation of the Census Office, they were able to print only a small portion of the material that was given them, but all of the manuscripts were retained by them until recently, when they were returned to the U. S. Fish Commission. Professor Goode and his associates have given much time to the preparation of these reports, the first two volumes of which have already appeared, and a large amount of additional material is now in type and will soon be ready for distribution. At least half a dozen more volumes similar in size to those al-

ready out will be published. These will describe in detail the fisheries of all the more important fishing towns, the history, methods and present extent of each of the special fisheries: the characteristics of the fishermen both at home and at sea, the character, extent and location of the principal fishing grounds, the apparatus of the fisheries, and in addition will give an exhaustive statistical review of the fishery industries of the country.

But these reports will picture the fisheries as they were in 1880, and if they are to be available for present use, they must be kept up to date. With the desire to keep abreast with any changes that might take place, Professor Baird has frequently, since that time, sent out committees for the investigation of special subjects. It has been my privilege to be on several of these committees of investigation, and I have found how comparatively easy it is for one, even though a stranger to the locality, to get control of the details of the fisheries of any village or stretch of coast. From my experience I have been convinced that it would be entirely practicable for the Commissioners of several States to familiarize themselves with the changes that are taking place within their own borders, and to collect from year to year full and complete statistics of the fish caught in the territory under their control, and to publish these for the information of the public in their annual reports.

I have been much pleased to see in the States of Michigan and Wisconsin a very commendable effort in this direction. I think the Commissioners of both of these States have so familiarized themselves with the details of the fisheries in their own waters and with the influence of each kind of apparatus of capture, that they will be better able to cope with the problem of legislation than the Commissioners of other States, and also to show more clearly the influence of their fish-cultural operations upon the yield of the commercial fisheries. Any one who has heard the conflicting statements of the fishermen when summoned to give evidence regarding proper legislation for the protection of the fisheries, cannot fail to appreciate the importance of a full knowledge of all important details. In the Great Lake fisheries the gill net and pound net fishermen are at sword points; one claiming that the other is using the most destructive apparatus

that could be devised, while the angling element, especially in the more eastern lakes, is opposed to both. There have been frequent attempts in various States to entirely prohibit the pound net fishing, and there have been equally strenuous efforts to prohibit the use of the gill net, and again laws have been framed forbidding the use of haul seines, while fishing with pound nets and gill nets was in no way restricted. Numerous attempts have also been made to control and protect the fisheries by regulating the size of the mesh, but the utter inability of legislation to protect the small fish by this means is shown very clearly by the remark made to me yesterday by one of the gentlemen present; who claimed that if it were possible to insist upon the use of a given size of mesh, the fishermen could still regulate the size of the fish taken quite as his pleasure, by simply pulling hard upon the upper cork line at one end of the net, and upon the lead line at the other end, so as to draw the meshes together, and thus prevent the very smallest fish from going through.

I bring this matter to your attention because I have come to feel the importance of a definite and positive knowledge in this contest, when parties interested and parties whose interests are not apparent are clamoring for legislation. I think the time has arrived when the Commissioners of the different States should stand between the contending elements and should settle definitely in the minds of the law makers, the questions which are up for consideration, and nothing, in my judgment, is more necessary to a proper understanding of these questions than a careful comparison of the yield of the fisheries of the various localities from year to year.

With a desire to obtain as reliable statistics as possible, the U. S. Fish Commission has recently, through the co-operation of the Treasury Department, established a series of reports in which I think you will all be interested. The Secretary of the Treasury has consented to require of the owner and master of each vessel engaged in the fisheries of the United States, regardless of the locality, a detailed statement regarding the size, the value and the rig of the vessel; the number of men employed; the kind of apparatus used; the locality where fishing; the quantities and values of the fish caught, and other questions of importance af-

fecting that particular vessel. We are receiving hundreds of these reports every month from all portions of the coast, including the Pacific coast, the Gulf of Mexico and the numerous fishing ports of the Atlantic ; and we are thus gathering a very large amount of information regarding the vessel fisheries, but the boat fisheries are still unprovided for, and if it were possible for the Commissioners of each of the States to arrange to get reliable estimates of the quantity of fish caught yearly within their own borders, the number of men that are dependent upon these fisheries, and the distribution of the catch, I think we would be able to show what legislation is needed, and consequently, which I consider more important, to show clearly the importance of fishculture in the commercial fisheries and the achievements that fishculture has already attained. I should be very glad if some of the Commissioners present would give us a statement of what has already been done in their waters and of the difficulties, if such exist, in carrying out the line proposed. It has been suggested this afternoon in conversation, that there would be considerable difficulty owing to the fact that many of the Commissioners have only limited appropriations placed at their disposal, while others receive nothing whatever for their services, these being gratuitous, but it occurred to me that by having intelligent correspondents in each of the leading centers, men in whom they had confidence, it would be possible to get together for the State reports, very valuable contributions to our information regarding the condition of the fisheries.

* * * * *

I will simply add for the information of any one here who sees no way of sending out agents to inquire as to the extent and value of the fisheries, that there is a growing prejudice among the commercial fishermen in favor of the work of the various State Commissioners and of the U. S. Fish Commissioner, and that they are now quite willing to give to the different commissions reliable information in answer to questions that may be asked. As a proof of this I will state that a circular was sent to each of the 1,600 vessels employed in the food fisheries of New England, and answers have been received from 1,560 of them, leaving only about 40 vessels out of the 1,600 that failed to respond. In the

case of the fisheries of the Great Lakes, inquiry circulars were recently sent to every fisherman on each of the five lakes, and more than ninety per cent. of them have been returned, and whenever, during the past two or three years, there has been an effort to obtain information by correspondence, this effort has been met with hearty co-operation on the part of those engaged in the commercial fisheries; so that even without the expenditure of any considerable amount of money, it will be possible for those who are familiar with the localities and with the more intelligent resident fishermen to obtain possession of information from which very satisfactory reports can be prepared.

Washington, D. C.

The meeting then adjourned until the following day.

THIRD DAY.

On assembling the Secretary read the following paper.

FISH PRESERVATION BY THE USE OF ACETIC, BORACIC, SALICYLIC, AND OTHER ACIDS AND COMPOUNDS.

BY A. HOWARD CLARK.

An important method of preventing decomposition of animal flesh, is the application of antiseptic salts in a powdered form to the surface of the substance or to impregnate it with a solution either by atmospheric or hydraulic pressure. Among the commonest and most effective antiseptics, exclusive of chloride of sodium (common salt) are acetic, as contained in vinegar, and boracic acid. The latter preservative is fast coming into favor in the preparation of fishery products, because of its very satis-

factory properties. As compounded with salt in the form of a powder or in solution with tartaric acid, boracic acid is found to effectually preserve either dry or pickled fish in good condition for a long time.

At the Fisheries Exhibition, at London, in 1883, some Pacific salmon were shown which had been packed in a solution of boracic acid and other ingredients for several weeks, and after their long land and water journey, they were removed from the solution and exposed to the atmosphere at the fish market for several days, still retaining most of their original flavor and freshness.

It is my purpose in this paper to enumerate some of the more important methods of preserving fish by chemical treatment. Only a few of the numerous compounds which have been brought to the notice of fish curers have come into commercial use, though it is probable that many of them would upon trial be found effectual and profitable.

At the Centennial Exposition, at Philadelphia in 1876, there were some exhibits of fresh oysters and clams preserved in chemical liquids, and which the juries on awards pronounced of good quality. Boracic acid was reported to preserve animal matter for several months without changing the texture as common salt does. Citric and acetic acids also proved good preservatives, and fish cured in these acids were, after a little soaking in fresh water, found free from all unpleasant flavor.

In Portugal, fish are kept fresh for a considerable time by removing the viscera and sprinkling the abdominal cavity with sugar, when they are hung up to allow the sugar to impregnate the flesh as much as possible.

I shall notice the several methods in the order of their commercial importance, beginning with acetic acid, which, next to common salt, is perhaps the principal antiseptic in use in this country.

Vinegar, Spices, etc.—Lobsters, oysters, oyster crabs, mussels, scallops and some other marine products are preserved in vinegar alone, and packed in glass jars, are common in the New York markets under the name of "pickled" products. Herring,

mackerel, and other fish are largely prepared with compounds of vinegar and spices and sold as Russian sardines, marinated fish, soured fish, and by other trade names. The preparation of Russian sardines from the common sea herring, was introduced in this country by some enterprising New York merchants during the Franco-Prussian war. The principal seat of operations was Eastport, Me., and the methods employed, as patented in 1875 by Messrs. Sellman, Reessing and Wolff, have been as follows: The fish while alive are thrown into strong brine contained in suitable casks on board the fishing vessels. This part of the process is important, as it not only kills the fish but prevents them from spoiling while being cleaned and cured. After being kept in the brine for at least ten days they are beheaded, gutted, scaled, and thoroughly cleaned in clear cold water and placed in large willow baskets or in sieves to drain off the superfluous water. In five or six hours they are spread upon packing tables and assorted as to size, each size being packed by themselves.

The fish are preserved and at the same time flavored by being packed with the following ingredients, the quantities given being for 120 lbs. of fish; Two gallons vinegar, 1½ lbs. allspice, 2oz. pepper, 4lbs. sliced onions, 2lbs. sliced horse radish, 1lb. bay leaves, ½lb. cloves, ¼lb. ginger, ¼lb. coriander seed, ¼lb. Chili pepper, and 2¼oz. capers.

In packing the fish a small quantity of vinegar and a thin layer of the other ingredients are placed in the bottom of the vessel and a layer of fish, placed back upward, are put in and gently pressed down. Another small quantity of vinegar and a thin layer of the other ingredients are put in and another layer of fish, and so on until the vessel is full. The fish are ready for market and consumption in about four days in summer and three to four weeks in winter.

Method of Souasing.—Soured mackerel and other fish may be prepared as follows: The fish are cut into pieces about 2 in. long and cleaned. A souse is made of cider vinegar and cloves, nutmeg or other spices, with parsley, bay leaf and onions, and the fish are immersed in this souse for twelve hours, when they are put in a second souse, made the same as the first with the ad-

dition of capers, olive oil, Worcestershire sauce, and extract of anchovy and lemons. After remaining in the second souse for ten hours, they are heated in the souse for four to eight hours at about 140 deg. Fahr. and are then packed with the souse in air-tight pots or jars.

2. *Acetic Acid and Carbonate of Soda.*—The fish to be preserved are put in barrels, or other packages, with a liquid composed of acetic acid and carbonate of soda, in sufficient quantities to make a slightly acid solution of acetate of soda, to which is added enough water to give the liquid a density of three to five degrees. A few grains of salt may be added to give an agreeable taste, and about five drops of nitrate of soda for each pound of the liquid to preserve the color of the substance. Prepared chalk may be used instead of carbonate of soda. The fish may be kept in this solution, or after being saturated with a denser liquid may be dried.

3. *Boracic Acid and Common Salt.*—In the United States, until within a very few years, little advantage has been taken in the fish trade of the effective preservative power of boracic acid in combination with common salt. In 1883, the writer found that at Gloucester, Mass., the headquarters in this country for the curing of dry salted fish, the use of boracic acid was just begun, and then only by a few curers. Since that date, however, "Preservaline" and other chemical powders having the above substances as their base have come into quite general use, particularly in the warmer months, when without this preservative it is often found impossible to keep dry fish in good condition for many weeks or even days. This powder checks the peculiar reddening so commonly seen on dry salted fish in summer.

The chemical powder used by the Norwegians in preserving fresh herring for export, is a mixture of boracic acid and salt, using about two pounds of salt to each pound of boracic acid. Herring are packed in barrels, in the ordinary method with alternate layers of fish and powder, and after the barrel is headed they are "pickled" with a weak solution of pure boracic acid. Fish preserved in this way will keep perfectly fresh and of their natural flavor for a week or even longer. The Norwegians have

already succeeded in profitably competing with Scotland in supplying the London market with fresh herring thus prepared. A more complete preservation of herring, so that they will keep in good order for a long time, is obtained by the Sahlstrom process and by the Roosen method by which a solution of boracic acid and salt is thoroughly impregnated into the flesh, under a pressure of 60 to 100 lbs. to the square inch. Successful experiments have been made in Scotland in treating fresh salmon by the Roosen process. Three hundred pounds of fish were packed in a strong steel barrel, and with a pressure pump the solution was forced into the salmon until they were thoroughly impregnated. After three weeks subjection to this process the fish were cooked and found of excellent flavor. Strongly made wooden barrels may be substituted for steel barrels, or, after being treated under pressure, the fish may be repacked with the solution in common fish barrels.

4. *Eckhart's Method*.—By this process, devised by John Eckhart, of Munich, and patented in 1880-'82, fish are prepared in a preserving salt consisting of a mixture of 50 per cent. common salt, 47½ per cent. chemically pure boracic acid, 2 per cent. tartaric acid, and ½ per cent. salicylic acid. The fish are first stripped of skin and bones, and the flesh is mixed with the preservative in the proportion of 20 grams of the mixture to one kilogram of fish flesh. They are then packed in cases of parchment or other material and put into casks which are filled with a gelatine solution made in the proportion of 50 grams of gelatine, 20 grams of the preservative, and 1,000 grams of water. The casks are then headed and connected with a force pump and more of the solution is forced in until the contents are well saturated. The sacks or cases of fish are then removed from the cask, and may be strewn over with more of the salt in dry condition and packed for shipment, or they may be shipped in casks with the liquid.

5. *Boracic and Acetic Acids*.—By the Am Ende process, boracic acid either in a liquid or pulverous state, is compounded with acetic acid in the proportion of about one drop of acetic to every ounce of boracic acid, and the compound is applied in the usual manner. The acetic acid is said to prevent the formation of fungi.

while the boracic acid prevents putrefaction by hindering the formation of bacteria.

6. *Boracic Acid, Chloride of Potassium, etc.*—The process devised by Hugo Jannish, consists in subjecting fish to a compound prepared of chloride of potassium, nitrate of soda, and chemically-pure boracic acid, which ingredients are dissolved in water, then mixed under exposure of heat, thus forming an antiseptic salt composed of hyponitrate of potash, hypochlorate of soda, borate of soda, borate of potash, and free boracic acid. The compound is applied either as a salt or in a more or less strong solution according to the time for which the fish are to be preserved.

7. *Borax, Saltpetre, etc.*—By the Herzen preserving process, meat is soaked for 24 to 36 hours in a solution of three parts borax, two boracic acid, three saltpetre, and one salt, in one hundred parts of water, and then packed in some of the solution. Before use the meat must be soaked 24 hours in fresh water.

8. *Glycerine and Antiseptic Salts.*—Oysters, fish, meats, etc., may be preserved by the use of a mixture of glycerine with phosphate of soda, or other antiseptic salt in connection with aldehyde, formic ether or acid in a solution of carbonic acid, water, glycerine, etc., and the preserved substance is then covered with paraffine or stearine.

9. *Miscellaneous Compounds.*—Among the many other chemical compounds that have been experimented with, and some of which have been successfully used in the commercial preservation of fish, may be mentioned :

a. A solution of gelatine and bisulphite of lime forced under pressure.

b. Fish flesh ground into fine pieces, pressed, moistened with glycerine, and wrapped in tinfoil.

c. A solution of saltpetre and alum in proportion of 5 lbs. of saltpetre and 4 oz. of alum to 60 gallons of sea water.

d. A solution of thymol, thymic acid, or any of the thymate salts and water, alcohol or glycerine.

e. Acetate of lime solution in water at a density of six degrees by the ærometer, to which is added acetic acid of eight degrees.

so that the liquid will produce sensible acid reaction upon blue reaction paper.

f. Sulphite of soda and carbolic acid in solution in proportion of 5 gals. water, 2 lbs. selphite of soda and 2oz. carbolic acid.

g. Hydrocarbon substituted for the air, which occupies the space in and around the substance to be preserved and subjecting the same to a temperature of about 30 deg. Fahr., the gas entering by a hole at the top and the air escaping through a hole in the bottom of the package.

h. A solution of salicylic acid dissolved in water, with which the fish is impregnated under hydraulic pressure.

i. Salicylic acid dissolved in hot glycerine and mixed with hot water. Preserving cans are coated on the inside with the above solution, then the fish are hermetically sealed in the ordinary manner.

j. A brine of composition for preserving fish, meat, etc.; consisting of a solution of starch, sugar or glucose and common salt.

k. Fish are packed in a dry powder of gypsum and carbon and then enveloped with plastic shell, composed of gypsum, carbon, silicate of soda and water.

l. Fish washed in lime water then rubbed with pepper, salt-petre and fine salt.

m. Fish packed in air-tight packages and subjected to vapor of chloroform.

n. Gaseous sulphide of carbon is forced into the fish.

o. A solution of equal parts of water and bisulphate of lime.

p. Fish are covered with a coating of gum and immersed in acetate of alumina then a solution of gelatine allowing the whole to dry on the surface.

q. Fish are immersed in a solution of gum, benzoin and alum.

Washington, D. C.

MR. MAY—The paper just read treats of preserving fish by means of acids and other compounds, but does not say what effect these preservatives have upon the human stomach. Is there any

member present who has eaten fish which had been kept by any of these processes?

MR. MATHER—I once ate a trout which had been kept for some ten days without ice. It was given to me by Mr. Thomas J. Conroy, of New York, the dealer in fishing tackle, and had been preserved by a patent process or powder called Rex Magnus, not now on the market, and which probably may have been largely composed of boracic acid, and the fish was fairly eatable, a little dry but still better than no fish.

MR. MAY—As our worthy secretary still lives, it is fair to presume that the use of these preparations does not bring on instant death, but what would be the result of eating a thousand such prepared fish?

MR. MATHER—I cannot say. Prawns preserved in some acid come to New York from Charleston and other southern ports, and I see them at Blackford's daily. I have here the quarterly number of the *Journal of the National Fish Culture Association*, edited by J. W. Willis Bund, Esq., and published by the Fish-culture Association of England, in which there are two items referring to this matter, which I will read. The first one favors the use of acids and the second one condemns them.

There are two sides to all questions. The *British Medical Journal* writes thus as to herrings cured with boracic acid: "Large quantities of herring preserved with salt and boracic acid being at present imported from Norway, and sold in the London and Newcastle markets, attempts have been made to prevent their sale. The National Sea Fisheries Protection Association discussed the question at a recent conference at Fish-mongers' Hall, but no decision as to such fish was arrived at. It may, therefore, be worth while to point out that boracic acid, being the essential ingredient of our many food preservatives—be it in the form of the acid, of boroglyceride, or of borax—has been used for years, especially to preserve milk in hot weather, and no evidence has ever been brought forward even to suggest injurious effects upon the health; it may, therefore, be taken to be perfectly harmless. The Norwegian herrings preserved with salt and boracic acid are of exceptionally fine quality, are per-

factly fresh when brought into the market, and are, of course, subject to the usual process of inspection by the market inspectors, whose power of rejection is almost absolute. If, nevertheless, an outcry is heard against this sale, it is difficult to resist the belief that it is dictated by the jealousy which is notoriously rife in Billingsgate circles.

"The introduction of cheap food from new sources, welcomed as it always is by the public, is invariably opposed by the trade who, after all, reap the chief advantage in the long run. One has but to recall the sneers of the meat venders at American and Australian meat to value the agitation against Norway herrings at its proper worth. Hitherto, happily, we have been spared the bitter discussions which have on the Continent led to legislation against certain food preservatives, such as salicylic acid, which we in England admit without hesitation. The question is mainly one of public economy: Shall good food be wasted for want of a preservative, even if certain objections may be urged against their use, or shall we put up with these objections and aim at cheapening food for the masses, provided, always, that nothing which could injuriously affect their health is allowed to be present? A sufficient guarantee is afforded by the vigilance of medical officers, public analysts and market inspectors against the abuse of antiseptics and food preservatives."

On the other hand, a fish trader writes to the *Fish Trade Gazette*: "Hundreds of barrels of herrings from Norway out of one cargo were condemned, and also, that there were about 1,500 barrels unsold lying in London at that time. France will not admit the Swedish and Norwegian herrings nor any other fish cured by the process named. Many shopkeepers soon find out to their cost that once their customers have tasted herrings cured with acid they don't ask for them a second time."

Mr. S. G. Worth explained a new method for outlets of fishponds which he illustrated by a diagram upon the blackboard, and of this no notes were taken as Mr. Worth promised to send them, but as the report goes to press, they have not arrived.

THE CHEMICAL CHANGES PRODUCED IN OYSTERS
IN FLOATING, AND THEIR EFFECT UPON
THE NUTRITIVE VALUE.

BY PROF. W. O. ATWATER.

It is a common practice of oyster dealers, instead of selling the oysters in the condition in which they are taken from the beds in salt water, to first place them for a time, forty-eight hours, more or less, in fresh or brackish water, in order, as the oyster-men say, to "fatten" them, the operation being called "floating" or "laying out." By this process the body of the oyster acquires such a plumpness and rotundity, and its bulk and weight are so increased as to materially increase its selling value.

The belief is common among oyster-men, that this "fattening" is due to an actual gain of flesh and fat, and that the nutritive value of the oyster is increased.

A moment's consideration of the chemistry and physiology of the subject will make it clear, not only that such an increase of tissue-substance in so short a time and with such scanty food-supply is out of the question, but that the increase of volume and weight of the bodies of the oysters is just what would be expected from the osmose or dialysis which would naturally take place between the contents of the bodies of the oysters as taken from salt water, and the fresh or brackish water in which they are floated.

If we fill a bladder with salt water and then put it into fresh water the salt water will gradually work its way out through the pores of the bladder and, at the same time, the fresher water will enter the bladder; and further, the fresh water will go in much more rapidly than the salt water goes out. The result will be that the amount of water in the bladder will be increased. It will swell by taking up more water than it loses, while, at the same time, it loses a portion of the salt.

It does this in obedience to a physical law, to which the term osmose and dialysis are applied. In accordance with this law,

if a membraneous sac holding salts in solution is immersed in a more dilute solution or impure water, the more concentrated solution will pass out and at the same time the water or more dilute solution will pass in and more rapidly. The escape of the concentrated and entrance of the dilute solution will be, in general the more rapid the greater the difference in concentration and the higher the temperature of the two solutions. After the osmose has proceeded for a time, the two solutions will become equally diluted. When this equilibrium between the two is reached the osmose will stop. If the sac which has become distended is elastic, it will, after osmose has ceased, tend to come back to its normal size, the extra quantity of solution which it has received, being driven out again.

We should expect these principles to apply to the oyster. Roughly speaking, the body of the animal may be regarded as a collection of membraneous sacs. It seems entirely reasonable to suppose, that the intercellular spaces and probably the cells of the body would be impregnated with the salts of the sea-water in which the animal lives, and this supposition is confirmed by the large quantity of mineral salts which the body is found by analysis to contain, and which amounts, in some cases, to over 14 per cent. of the water-free substance of the body.

It seems equally reasonable to assume that osmose would take place through both the outer coating of the body and the cell walls. In the salt water the solution of salts within the body may be assumed to be in equilibrium with the surrounding medium. When the animal is brought into fresh or brackish water *i.e.*, into a more dilute solution, the salts in the more concentrated solution within the body would tend to pass in and produce just such a distension as actually takes place in the floating. If this assumption is correct, we should expect that the osmose would be the more rapid the less the amount of salts in the surrounding water; that it would proceed more rapidly in warm and more slowly in cold water; that it would take place whether the body of the animal is left in the shell or is previously removed from it; that the quantity of salts would be greatly reduced in floating; and that if it were left in the water after the maximum distension had been reached, the imbibed

water would pass out again and the oyster would be reduced to its original size. Just such is actually the case. Oyster-men find that the oysters "fatten" much more quickly in fresh than in brackish water; warmth is so favorable to the process that it is said to be sometimes found profitable to warm artificially the water in which the oysters are floated; although oysters are generally floated in the shell, the same effect is very commonly obtained by adding fresh water to the oysters after they have been taken out of the shell, indeed, I am told that this is a by no means unusual practice of retail dealers; oysters lose much of their salty flavor in floating; and it is a common experience of oyster-men that if the "fattened" oysters are left too long on the floats they become "lean" again.

This exact agreement of theory and fact might seem to warrant the conclusion that the actual changes in the so called fattening of oysters in floating are essentially gain of water and loss of salts. The absolute proof however is to be sought in chemical analysis. In the course of an investigation conducted under the auspices of the United States Fish Commission, and which included examinations of a number of specimens of oysters and other shell-fish, I have improved the opportunity to test this matter by some analysis of oysters before and after floating. The results of the investigation are to be given in one of the publications of the Commission. From this the following statements are selected as perhaps not without interest to the Fisheries Association. It is not improper that I should add here, that a portion of the expenses of the investigation was borne by one of the prominent officers of the association, Mr. E. G. Blackford.

The account just mentioned of the experiments is preceded by some citations regarding the practice of floating oysters which I insert here, adding that I should be greatly obliged for any further information upon the subject.

The following very opposite statements* are by Prof. Persi-
for Frazer, Jr., who attributes the changes mentioned to dialytic
action.

* Note on Dialysis in Oyster Culture in Proceedings of Philadelphia Academy of Sciences, 1873 p. 472.

"The oysters brought to our large markets on the Atlantic seaboard are generally first subjected to a process of "laying out," which consists in placing them for a short time in fresher water than that from which they have been taken.

"Persons who are fond of this animal as an article of food know how much the 'fresh' exceed the 'salts' in size and consistency. The 'Morris Coves' of this city, (Philadelphia) while very insipid, are the plumpest bivalves brought to market. On the other hand, the 'Absecons' and 'Brigantines,' while of a better flavor (to those who prefer salt oysters), are invariably lean, compared to their transplanted rivals, as also are the 'Cape Mays,' though from some reason, not to the same extent.

"The most experienced oyster dealers inform me, that the time for allowing the salt oysters taken from the sea-coast to lie out, varies, but is seldom over two or three days. At the end of this time the maximum plumpness is attained, and beyond this, the oyster becomes lean again, besides having lost in flavor."

The subjoined statements by Prof. J. A. Ryder are interesting in this connection. They are taken from a letter to Prof. Baird, U. S. Commissioner of Fish and Fisheries on "Floats for the so-called fattening of oysters."*

"The simplest and most practical structures of the kind which I have seen are the storage and fattening floats used by Mr. Conger, of Franklin City, Md., and now in use by all the shippers and planters in the vicinity of Chincoteague Bay. I have been informed that similar structures, or rather structures serving similar purposes, are in use on the oyster-beds along the shore of Staten Island, New York.

"It is probably a fact that in all these contrivances they take advantage of the effect produced by fresher water upon oysters which have been taken from slightly saltier water. The planters of Chincoteague call this 'plumping the oysters for market.' It does not mean that the oysters are augmented in volume by the addition of substantial matter, such as occurs during the actual appropriation of food, but only that the vascular spaces

* Bulletin of the U. S. Fish Commission, 1894, p. 302.

and vessels in the animals are filled with a larger relative amount of water due to endosmose. It is a dealer's trick to give his product a better appearance in the market, and as such I do not think deserves encouragement, but rather exposure.

"Mr. Conger has actually resorted to warming fresh water to 60 fahr. in winter by steam pipes running underneath the wooden inclosure surrounding the 'fattening' or 'plumping' float. One good 'drink,' as he expressed himself to me, renders the animals fit for sale and of better appearance.

"Conger's floats are simply a pair of windlasses supported by two pairs of piles driven into the bottom. Chains or ropes which wind upon the windlasses pass down to a pair of cross pieces, upon which the float rests, which has a perforated or strong slat bottom and a rim 18 inches to 2 feet high. These floats I should think are about 8 feet wide and 16 feet long, perhaps 20. These structures are usually built alongside the wharfs of the packing and shipping houses and are really a great convenience in conducting the work."

Elsewhere Prof. Ryder speaks of the floats thus:

"The diaphragm itself was constructed of boards perforated with auger holes, and lined on the inside with gunny-cloth or sacking; and the space between the perforated boards was filled with sharp, clean sand. The space between the boards was about 2 inches; through this the tide ebbed and flowed, giving a rise and fall of from 4 to 6 inches during the interval between successive tides."

Mr. F. T. Lane of New Haven, Conn., writes as follows about the method of floating practiced by himself, and as I understand, by other New Haven growers:

"We do not always leave them two days in the floats,—as a rule, only one day. We put them into brackish water and take them out at low water or in the last of the falling tide as then the water is the freshest and the oysters are at their best. As it is not convenient for us to put them into the floats and take them out the same day we do not want the water too fresh. On one occasion, wishing to know what the result would be of putting the oysters into water that was quite fresh I had one of my floats taken up the river half a mile further than where we commonly

use them and 100 bushels of oysters put into it at high water and taken out at low water. They were in the water from 6 to 7 hours and came out very nice, fully as good as those floated 24 hours in the brackish water. It was a warm day and the water was warm. Under these conditions they will drink very quickly. I have seen them open their shells in 10 minutes after they were put into the water."

For the following valuable information I am indebted to Mr. R. G. Pike, Chairman of the Board of Shell-fish Commissioners of Connecticut:

"Connecticut oysters, when brought from their beds in the salt waters of Long Island Sound, are seldom sent to market before they have been subjected to more or less manipulation. As soon as possible after being gathered, they are deposited in shallow tide rivers where the water is more or less brackish; and are left there from one to four days; the time varying according to the temperature of the season, the saltiness of the oyster, and the freshening quality of the water. Generally two tides are sufficient for the two 'good drinks' which the oyster-men say they should always have.

"This 'floating,' as it is called, results in cleaning out, and freshening the oysters, and increasing their bulk; or, as many oyster-men confidently assert, 'fattening' them. If the weather is warm, they will take a 'drink' immediately, if not disturbed; but if the weather is cold they will wait sometimes ten or twelve hours before opening their valves. Good fat oysters generally yield five quarts of solid meat to the bushel; but after floating two tides or more, they will measure six quarts to the bushel. After they have been properly floated they are taken from the shell—and as soon as the liquor is all strained off, they are washed in cold fresh water—and are then packed for market. In warm weather they are put into the water with ice, and are also packed with ice for shipping. Water increases their bulk by absorption and by mixing with the liquor on the surface of the oysters. The saltier the oyster the more water it absorbs. In twelve hours one gallon of oysters, with their juices strained out, will take in a pint of water; but when very salt and dry they have been known to absorb a pint in three hours.

"Water always thickens the natural juices that adhere to the surface of the oyster; and makes them slimy. If too much water is added the oyster loses its plumpness and firmness and becomes watery and flabby.

"Oysters that have been floated bear transportation in the shell much better than when shipped directly from their beds. Oysters, too, that are taken from their shells and packed in all their native juices spoil much sooner than when their juices are strained out and the meats are washed in fresh cold water.

"Long clams are not floated—but round clams are. But both, when shucked are washed in fresh water. This cleanses them of mud, sand and excess of salt; increases their bulk and improves their flavor. After washing they will keep much longer without risk of spoiling. If the salt is left in them, as they come from their native beds, their liquor will ferment and they will quickly spoil.

"The above facts are gathered from the most intelligent men in the shell-fish business in Connecticut,—men who have had many years experience in gathering oysters and clams and preparing them for home and foreign consumption. They are all agreed that by judicious floating in the shell, and by washing and soaking when out of the shell, the oyster and the clam increase in bulk and improve in quality and flavor. We will not presume to say that this increased bulk is anything more than a mechanical distension of the organs and the cellular tissues of the oyster by water; or that its improved flavor is not due simply to a loss of bitter sea salt dissolved out by the water. Many intelligent cultivators are confident that the increase in bulk is a growth of fat; while just as many, of equal intelligence, declare that it is mere 'bloat' or distention, akin to that of a dry sponge when plunged into the water. The exact nature of the change the chemist alone can determine."

The following experiments were made with oysters supplied by Mr. F. T. Lane, of New Haven, Conn., a communication from whom was just quoted, and for whose courteous aid as well in furnishing the specimens as in giving useful information, I take this occasion to express thanks.

The oysters had been brought from the James and Potoma

Rivers and "planted" in the beds in New Haven Harbor (Long Island Sound) in April, 1881, and were taken for analysis in the following November.

Two experiments were made. The plan of each experiment consisted in analysing two lots of oysters, of which both had been taken from the same bed at the same time, but one had been "floated" while the other had not. The first specimen was selected from a boat-load as they were taken from the salt water, and the second from the same lot after they had been floated in the usual way in brackish water for forty-eight hours. For each of the two experiments, Mr. Lane selected, from a boat-load of oysters as they were taken from the salt water, a number, about three dozen, which fairly represented the whole boat-load. The remainder were taken to the brackish water of a stream emptying into the bay and kept upon the floats for forty-eight hours, this being the usual practice in the floating of oysters in this region. At the end of that time, the oysters were taken from the floats and a number fairly representing the whole were selected as before. Two lots, one floated and the other not floated, were thus taken from each of two different beds. The four lots were brought to our laboratory for analysis.

The specimens as received at the laboratory were weighed. Thereupon, the shell-contents were taken out and the shells and shell-contents both weighed. The solid and liquid portions of the shell-contents, *i.e.*, the flesh or "solid" and "liquor" or liquids were weighed separately, and then analyzed. We thus had for each lot, the weights of flesh and liquids, which, together, made the weight of the total shell contents, and the weight of the shells, which with that of the shell-contents made the weight of the whole specimens. We also had, from the analysis, the percentages of water, nutritive ingredients, salts, &c., in the flesh and in the liquids. From these data the calculations were made of the changes which took place in floating. For the details, which are somewhat extended, I may refer to the publications mentioned above. It will suffice here to give only the main results.

The body of the animal may be regarded as made up of water and so-called water-free substance. The water-free substance

contains the nutritive ingredients or "nutrients." These may be divided into four classes: (1) Protein compounds, the so-called "fleshformers" which contain nitrogen; (2) fatty substances, classed as Fats; (3) Carbohydrates; (4) Mineral Salts.* These constituents of the flesh of oysters have been but little studied. It is customary to assume them to be similar to the corresponding compounds of other food-materials, but very probably the differences, if known, might prove to be important. The mineral matters especially which are very large in amount, appear to include considerable of the salts of sea-water. Of the nature of the ingredients of the liquids but little is known. They consist mainly of water and salts and the amounts of their ingredients which are here reckoned as protein, fats and carbohydrates are very small, so that whatever error there may be in classing them with the ordinary nutrients of food, it will not very seriously affect the estimates of nutritive values.

GERERAL RESULTS OF THE EXPERIMENTS.

During the sojourn in brackish water both the flesh (body) and the liquid portion of the shell-contents of the oysters suffered more or less alteration in composition. In order to show clearly what the principal changes as shown by the chemical analysis were, some statistics may perhaps be permissible here.

CHANGES IN THE COMPOSITION OF THE FLESH (BODY) OF THE OYSTERS IN FLOATING.

1. The changes in the constituents of the body were mainly

* The technical terms here used demand perhaps a word of explanation. The "water-free substance" is the dry matter which is left when the water has all been driven out. Over three-quarters of the whole weight of the flesh ("solids") of oysters is water, so that the water-free substance makes less than one-fourth of the whole weight. As the oysters are ordinarily sold, i.e. after being floated, the flesh averages about one-fifth water-free substance. Taking both the flesh ("meat") and liquids ("liquor") together, the oysters as commonly retailed in our markets are about seven-eighths water and one-eighth water-free substance. That is to say the actual nutritive material in oysters as we usually buy them makes on the average just about one-eighth of the whole weight. It is worth noting that this proportion of actual nutriment is very near the same as in milk. The protein includes the parts of the oyster that are similar to the lean of meats, white of egg, casein of milk. &c The quantities of protein and of fatty and oily substance in the flesh of oysters is smaller, while that of carbohydrates (substances allied to sugar and starch) is far larger than in ordinary meats.

such as would be caused by osmose, though there were indications of secretion of nitrogenous matters and, especially, of fats, which are not so easily explained by osmose. This I will speak of later.

2. The amounts of gain and loss of constituents which the bodies of the oysters experienced may be estimated either by comparing the percentages found by analysis before and after dialysis, or by comparing the absolute weight of a given quantity of flesh and the weights of each of its ingredients before, with the weights of the same flesh and of its ingredients after dialysis. For the estimate by the first method we have simply to compare the results of the analyses of the floated and the not-floated specimens. Taking the averages of the two experiments, it appears that:—

The percentages of	Before Dialysis	to	After Dialysis
Water rose from	77.9		82.4
Water-free substance fell from	22.1	"	17.6
Total flesh	100.0		100.0
Protein fell from	10.5	"	8.9
Fat fell from	2.5	"	1.9
Carbohydrates &c., fell from	6.9	"	5.2
Mineral salts fell from	2.2	"	1.6
Total water-free substance of flesh	22.1		17.6

There was, accordingly, a gain in the percentage of water and a loss of that in each of the ingredients of the water-free substance. This accords exactly with the supposition that during the floating the flesh gained water and lost salts and other ingredients.

It will be more to the point to note the absolute increase and decrease in amounts of flesh and its constituents—in other words, the actual gain or loss of each, in the floating. Estimates by this method have been made and explained in the detailed accounts referred to. They make it appear that 100 grams of the flesh as it came from the salt water was increased by floating, in one specimen, to 120.9, and in the other to 113.4 grams. This is equivalent to saying, that the two specimens of flesh gained

in the floating, respectively, 20.9 and 13.4 per cent., or, on the average, 17.3 per cent. of their original weight. By the same estimates the water-free substance in the 100 grams of flesh before the floating, weighed, on the average, 22.1 grams, while that of the same flesh after floating weighed only 20.6 grams making a loss of 1.5 grams or 6.6 per cent. of the 22.1 grams which the water-free substance weighed before dialysis. The main results of the two experiments thus computed, may be stated as follows:—

In the "floating" of 100 grams of flesh (body) of the oysters:

The Weight of	Before Dialysis.	After Dialysis.
Water rose from	77.9 grams to	96.6 grams.
Water-free substance fell from ..	22.1 " "	20.6 "
Whole flesh rose from	100.0 " "	117.2 "
Protein was assumed to remain the same	10.5 " "	10.5 "
Fat (ether extract) fell from	2.5 " "	2.3 "
Carbohydrates &c., fell from	6.9 " "	6.0 "
Mineral salts (ash) fell from	2.2 " "	1.8 "
	22.1	20.6

Estimating the increase or decrease of weight of each constituent in per cent. of its weight before floating:—

	Per cent of original weight.
The water gained	23.9
The water-free substance lost	6.6
The whole flesh (body) gained	17.3
The protein was assumed to neither gain nor lose.	
The fat lost	8.8
The carbohydrates, &c., lost	12.5
The mineral salts lost	15.5

In brief, according to these computations, the flesh lost between one-sixth and one-seventh of its mineral salts, one-eighth of its carbohydrates, and one-twelfth of its fats, but gained enough water to make up this loss and to increase its whole weight, by an amount equal to from one-seventh to one-fifth of the original weight.

These estimates are based on the assumption that the amount

of protein in the flesh remained unchanged during the floating. It seems probable however that the flesh may have lost a small amount of nitrogenous material. If this was the case the actual gain of flesh and of water must have been less and the loss of fats, carbohydrates and mineral salts, greater than the estimates make them. But there appears to be every reason to believe that the error must be very small, and since it would affect all the ingredients in the same ratio, the main result, namely, that there was a large gain of water and a considerable loss not only of mineral salts, but of fats and carbohydrates as well, can not be questioned.

CHANGES IN THE COMPOSITION OF THE LIQUID PORTION. (LIQUOR).

3. The liquids might be expected to receive material from the flesh, and to yield material to the surrounding water. The materials coming from the flesh would be such as the latter parted with by either osmose or secretion. Those yielded to the water would either escape by diffusion or be washed away when the shells were open wide enough to allow. What share each of these agencies had in effecting the changes that actually occurred in the liquids, the experiments do not and, in the nature of the case, cannot, tell. Comparing the percentage composition of the liquids before and after floating, as shown by the averages of the analyses in the two experiments, it appears that:—

The percentages of	Before Dialysis.	After Dialysis.
Water rose from.....	94.9	to 95.5
Water-free substance fell from.....	5.1	" 4.5
Total	100.0	" 100.0
Protein rose from...	1.9	" 2.1
Carbohydrates, &c., rose from.....	0.7	" 1.1
Mineral salts fell from	2.5	" 1.3

The increase in the percentage of water, and the decrease in that of mineral salts are very marked. The quantities of fats ("ether extract") are too small to be taken into account. The increase of nitrogen and that of carbohydrates, though absolutely

small, are nevertheless outside the limits of error of analysis, and must, like those of the salts, represent actual changes in the composition of the liquids.

The experiments give no reliable data for the determinations of the absolute increase and decrease of the liquids and their constituents, so that it is impossible to say with entire certainty whether there was or was not an actual gain of protein or fats or carbohydrates. It would seem extremely probable however that the liquids received and retained small quantities of these materials from the flesh (bodies) of the animals.

CHANGES IN THE COMPOSITION OF THE WHOLE SHELL-CONTENTS,
FLESH AND LIQUIDS.

4. Comparing the average percentage composition of the total shell-contents before and after floating in the two experiments, it appears that:—

The percentages of	Before Dialysis.	After Dialysis.
Water rose from	85.2	to 87.1
Water-free substance fell from	14.8	" 12.9
Total	100.0	100.0
Protein (N. X. 6.25) fell from	6.8	" 6.5
Fats, (ether extract) fell from	1.4	" 1.2
Carbohydrates, &c., fell from	4.3	" 3.7
Mineral salts, (ash) fell from	2.3	" 1.5
Total water-free substance	14.8	12.9

After so much detail, I ought perhaps to simply summarise the results in a few words and close. But one or two matters call for brief notice.

If the changes in composition of the oysters in floating were due to osmose or dialysis alone, we should expect simply a gain of water and loss of salts (and perhaps of carbohydrates). But the flesh seems to have lost a little carbohydrates and fats and probably protein also, along with the salts, while it was absorbing water. A way in which this may have come about is suggested by my colleague, Prof. H. W. Conn, who calls attention to the fact that some mollusks, when irritated, produce an extremely

abundant secretion of mucous or "slime," so much, indeed, as to sometimes render a small quantity of water in which the animals may be confined, quite sensibly gelatinous. He suggests that the change to fresh water may, indeed, induce such a secretion of mucous and perhaps of carbohydrates and fats as well, which would account for the increase of these substances in the liquids. The observation of oyster dealers that water always thickens the natural juices that adhere to the surface of the oyster and makes it slimy," accords with Prof. Conn's statement.

If such secretion did take place, the flesh must probably have lost a little protein during the floating. The estimates of absolute gain and loss of weight of flesh and ingredients (see detailed accounts of the experiments) are based upon the assumption that the quantity of protein was unaltered in floating. If protein was given off, therefore, the estimates are wrong. But the quantity of protein secreted and the consequent error must be, at most, very slight. If there is an error its effect would be to make the quantities of nutrients after floating appear larger than they really were. In other words, if the error was corrected it would make the loss of nutritive material in floating greater than it appears to be in the figures above given. As explained in the detailed report above referred to, I have assumed that the changes due to the ordinary processes of metabolism would be too small to materially affect the results.

The experiments might have been so conducted as to decide this question. It would have been necessary to simply take a larger number in each lot before and after floating and be certain that the number, weight, and bulk were the same in the floated and not-floated lots of each experiment. For instance, we might, in each experiment, carefully select two lots of, say a bushel, each, as taken from the beds, have the number of oysters the same in each bushel as an additional assurance that the two lots were alike, float one bushel and weigh and analyze both. A few experiments of this sort made under different conditions of time, temperature, kind and age of oysters, &c., would give reliable and valuable data. Unfortunately the means at my disposal did not permit so thorough experiments. I am

persuaded, however, that the results of such series of trials, if they could be made,—and I wish they might be—would be very similar to those of the trials here reported.

It is very interesting to note that these processes which we have been considering in the body of oyster are apparently very similar to processes which go on in our own bodies, namely those by which our food, after it is digested, finds its way through the walls of the stomach and other parts of the alimentary canal into the blood, to be used for nourishment. Physiologists tell us that the passage of the digested materials through the walls of the canal is in part merely a physical action, due to osmose, but that it is in part merely dependent upon a special function of the organs. In like manner the changes in the composition of the oyster, if the above explanation be correct, are caused partly by osmose, and partly by special secretive action, the cell walls and outer coating of the body of the oyster corresponding to the walls of the alimentary canal in the human body.

CONCLUSIONS.

The main points presented in this paper may be very briefly summarized thus.

In the floating of oysters for the market a practice which is very general and is also used for other shell-fish, the animals are either taken direct from the beds in salt water and kept for a time in fresher (brackish) water before opening, or water is added to the shell-contents after they are taken out of the shell.

When this treated, the body of the animal takes up water and parts with some of its salts; and small quantities of the nutritive ingredients escape at the same time. The oysters thus become more plump and increase considerably in bulk and weight. But the quantity of nutritive material, so far from increasing, suffers a slight loss.

In the experiments here reported, the increase in bulk and weight amounted to from one-eighth to one-fifth of the original amounts. This proportion of increase is about the same as is said to occur in the ordinary practice of floating or "fattening" for the market. According to this, five quarts of oysters in their

natural condition would take up water enough in "floating" to increase their bulk to nearly or quite six quarts, but the six quarts of floated oysters would contain a trifle less of actual nutrients than the five quarts not floated.

The gain of water and loss of salts is evidently due to osmose. The more concentrated solution of salts in the body of the animal as taken from salt water, passes into the more dilute solution (fresher water) in which it is immersed, while a larger amount of the fresher water at the same time enters the body. But part of the exchange and especially that by which other materials, namely fat, carbohydrates, protein, &c., are given off in small quantities, is more probably due to a special secretory action. There is thus a very interesting parallelism between these processes of secretion and osmose (dialysis) in the oyster and those in the bodies of higher animals, including man, by which the digested food is carried through the walls of the alimentary canal into the blood.

The flavor of oysters is improved by the removal of the salts in floating and they are said to bear transporting and to keep better. When therefore the oyster-man takes "good fat oysters" which "yields five quarts of solid meat to the bushel" and floats them so that "they will yield six quarts to the bushel" and thus has an extra quart of the largest and highest priced oysters, to sell, he offers his customers no more nutritive material—indeed, a very little less—than he would have in the five quarts if he had not floated them. But many people prefer the flavor of the floated oysters and since they buy them more for the flavor than for the nutriment, doubtless very few customers would complain if they understood all the facts. And considering that the practice is very general and the prices are regulated by free competition, the watering of oysters by floating in the shell, perhaps, ought not to be called fraudulent. But rather than pronounce upon this and other questions suggested by the above considerations, I should prefer to leave them to the Association for discussion.

NORTH CAROLINA ENCOURAGEMENT TO SHELLFISH CULTURE.

BY S. G. WORTH (RECENT STATE COMMISSIONER).

MR. PRESIDENT—The subject to which I desire to direct the attention of the Association is the new oyster law of my native State, North Carolina. When, four years ago, I met Lieut. Francis Winslow urging before this body the adoption of a resolution declaring in favor of private ownership of oyster bottom, I became impressed with his views, and brought about, after months of ceaseless work, the passage of a resolution in the North Caroline Legislature of 1885, instructing the State Board of Agriculture to expend \$2,000 on a survey of the oyster area, looking to the adoption of the principle of ownership in fee simple. Accordingly the work was done, and two years later, in the session of January-February, 1887, in consequence of the able report of Lieut. Winslow, an act was passed which puts on sale, at twenty-five cents an acre, nearly a million acres.

Owing to apprehensions of assemblymen, lest too big a step should be taken at once, the bottom within two miles of the shore was exempted from the general provisions of the act and left under jurisdiction of the several counties, but the main body of Pamlico Sound and much additional area was put on sale, except the well established natural beds. These, as public beds, were exempted and still remain the common property of the people. Under laws operative prior to the new act, no person could own more than ten acres in a county, and as a consequence the limited areas precluded the use of dredges and restrained healthy growth. Under the new act a person can own any amount up to a square mile. The new law is regarded by the press of North Carolina as an advanced movement, and as the law found its origin in a meeting of this body, I now gladly lay it before you entire, with all that may be good or bad in it, and invite friendly criticism from members practically experienced in such legislation, looking to modifications which may be suggested to the next General Assembly in the interest of the people at large.

The Board of Shellfish Commissioners is elected outside the membership of the State Board of Agriculture, and consists of three—W. J. Griffin, Elizabeth City, Pasquotank county; I. B. Watson, Hyde county, and W. T. Caho, Bayboro, Pamlico county. Lieut. Francis Winslow, schooner *Scoresby*, of the U. S. Navy, is conducting all details of a complete survey.

THE ACT.

An act to promote the cultivation of shellfish in the State [of North Carolina].

The General Assembly of North Carolina do enact:

SECTION 1. That the State shall exercise exclusive jurisdiction and control over all shellfisheries which are or may be located in the boundaries of the State, south of Roanoke and Croatan Sounds and north of Core Sound.

SEC. 2. In order to carry out the purposes of this act, the southern boundary line of Hyde county shall extend from the middle of Ocracoke Inlet to the Royal Shoal Lighthouse, thence across Pamlico Sound and with the middle line of Pamlico and Pungo rivers to the dividing line between the counties of Hyde and Beaufort, and the northern boundary line of Carteret County shall extend from the middle of Ocracoke Inlet to the Royal Shoal Lighthouse, thence to the Brant Island Shoal Lighthouse, thence across Pamlico Sound to a point midway between Maw Point and Point of Marsh, and thence with the middle line of the Neuse River to the dividing line between the counties of Carteret, Craven or Pamlico, and that portion of Pamlico Sound and the Neuse and Pamlico rivers not within the boundaries of Dare, Hyde or Carteret counties, and not a part of any other county, shall be in the county of Pamlico, and for the purposes of this act and in the execution of the requirements thereof the shore line as now defined by the U. S. Coast and Geodetic Survey shall be accepted as correct.

SEC. 3. The State Board of Agriculture shall, at the next regular meeting following the passage of this act, elect three commissioners of shellfisheries, whose term of office shall be one year, and the said Board of Commissioners of Shellfisheries shall be maintained so long as may be necessary to carry out the special duties confided to them by the provisions of this act and no longer, and they shall employ

such engineers and clerks as may be necessary for the execution of the said duties, and fix their compensation.

SEC. 4. The Board of Shellfish Commissioners shall make or cause to be made a survey and map of the area hereinbefore described, whereon shall be shown the location and area of all the natural beds, and of all the grounds which may have been occupied under authority of previous acts for the growing, planting or cultivation of shellfish, and upon the completion of the said survey in and maps of each or any county, the Board of Commissioners of Shellfisheries shall determine the location, area, limits and designation of each and every public ground in the county, and such public grounds are to include the natural beds, together with such additional areas adjacent thereto as may be deemed by the Board of Commissioners as necessary to provide for the natural expansion of the said natural beds; and having decided upon the location, area, limits and designation of the said public grounds, the Board of Commissioners of Shellfisheries shall publish the same for the period of thirty days at the court house door, and in four other public places in the county wherein the said public grounds are located, and any person or persons objecting to the decision of the Board of Commissioners of Shellfisheries, as published, may file a written protest, stating the ground for his or their objections, within the said thirty days, with the clerk of the Superior Court of the county wherein the said publication is made, upon payment to the said clerk of the sum of twenty-five cents, and at the expiration of the said thirty days, the said clerk of the Superior Court shall forward all such written protests to the Board of Shellfish Commissioners, and in case such protests are so filed and forwarded, the said Commissioners, or a majority of them, shall upon fifteen days' notice in writing, mailed or personally delivered to all parties in interest, hear and pass upon such protests or objections in the county in which the said public grounds are located; and the said Board of Commissioners of Shellfisheries, having fully informed themselves of the facts in the case, shall make within twenty days from the conclusion of the hearing a decision, which shall be final, and shall be so considered until reversed on appeal to the Superior Court. And at all hearings authorized by this act said Commissioners may, by themselves or their clerk, subpoena witnesses and administer oaths, as in court of law.

SEC. 5. The Board of Commissioners of Shellfisheries shall, upon making the said final decisions as to the location, limits, area and designation of the several public grounds in the county, publish the same in the county in which the said public grounds are located, and in two newspapers having a general circulation in the State, and shall

announce in the said publication that at the expiration of twenty days from the first day of publication, the territory within said county and embraced within the provisions of this act will be open for entry in manner and form as hereinafter provided, and any person or persons desiring to raise, plant, or cultivate shellfish upon any ground in the county which has not been designated as public ground by the Board of Shellfish Commissioners, may, at the expiration of the said period of twenty days, make an application in writing, in which shall be stated as nearly as may be, the area, limits and location of the ground desired to the entry-taker of the county in which the said area for which application is made is situated, for a franchise for the purpose of raising or cultivating shellfish in said grounds, and the said entry-taker, having received said application, shall proceed as with all other entries, as provided in Section 2,765 of the Code, as amended, except that the warrant to survey and locate the ground or grounds shall be delivered to the engineer appointed by the Board of Commissioners of Shellfisheries and not to the county surveyor, and the said engineer shall make such surveys in accordance with the provisions of Section 2,769 of the Code, except that it shall not be necessary to employ chain-bearers, nor to administer oaths to assistants, nor to make surveys according to the priority of the application or warrant.

SEC. 6. The Secretary of State, on receipt of the Auditor's certificate as provided in Section 2,778 of the Code, shall grant to the applicant a written instrument conveying a perpetual franchise for the purpose of raising and cultivating shellfish in and to the grounds for which application is made, and the said written instrument of conveyance shall be authenticated by the Governor, countersigned by the Secretary, and recorded in his office. The date of the application for the franchise and a description of the ground for which such franchise was granted shall be inserted in each instrument, and no grant shall issue except in accordance with a certificate from the engineer of the commissioners of shellfisheries, as to the area, limits and location of the grounds in which the said franchise is to be granted, and every person obtaining such grant or franchise, shall within three months from the receipt of the same, record the said written instrument in the office of the register of deeds for the county wherein the said grounds may lie, and shall define the boundaries of the said grounds by suitable stakes, buoys, ranges or monuments; but no franchise shall be given in or to any of the public grounds as determined by the Commissioners of Shellfisheries, and all franchises granted under this or previous acts shall be and remain in the grantee, his heirs and legal representatives, provided that the holder or holders shall make in

good faith, within five years from the day of obtaining said franchise, an actual effort to raise and cultivate shellfish on said grounds. And provided further that the area hereinbefore described, lying within two statute miles of the main land or any island, shall be entered or held only by residents of the State of North Carolina, and no grant shall be made to any one person of more than ten acres of said territory, and no person shall hold more than ten acres in any creek unless the same shall be acquired through devise, inheritance or marriage. And all that territory within the provisions of this act and lying more than two miles from the mainland or any island, shall be subject to entry by any person, but no person shall be permitted to enter in any one period for five years, more than six hundred and forty acres.

SEC. 7. Twenty-five cents per acre shall be paid to the State Treasurer for all franchises granted, and all moneys received for the granting of franchises, or for taxes laid on the said grounds or on property thereon, shall be set apart and kept separate for the purpose of defraying the expenses entailed by the provision of this act, and any moneys remaining after the payment of said expenses shall be paid into and credited to the school fund.

SEC. 8. The Secretary of State is hereby authorized and empowered to hire and take upon leases, not exceeding a term of ten years, in the name and behalf of the State, any such plot or plots of ground within the State as may be deemed necessary for the constructing, erecting, setting, maintaining and protecting of signals, beacons, bound-stones, posts or buoys to be used in designating, locating, surveying or mapping any shellfish grounds, and any person who shall willfully injure or remove any such beacon, bound-stone, post or buoy, or any part, appurtenance or enclosure thereof, or any buoy, stake, mark or range of any private or public shellfish ground, shall be guilty of a misdemeanor.

SEC. 9. All grounds taken up or held under this or previous acts shall be subject to taxation as real estate and shall be so considered in the settlement of the estates of deceased or insolvent persons.

SEC. 10. The Board of County Commissioners shall have entire control and jurisdiction over all public grounds lying within the boundaries of the counties, shall place and maintain such marks, and shall prescribe and publish at the court-house door and at four other public places in the county, such rules and regulations as may be necessary for the governance and control of the fisheries on such public grounds.

SEC. 11. Any person who shall willfully commit any trespass or in-

jury with any instrument or implement upon any ground designated under this act, upon which shellfish are being raised or cultivated, or shall remove, destroy or deface any mark or monument set up by the Board of County Commissioners, by virtue of Section 10 of this act, or who shall violate the rules and regulations prescribed by the said board of the governance and control of the fishery on the public grounds, or who shall work on any oyster ground at night shall be guilty of a misdemeanor. But nothing in the provision of this or any act shall be construed as authorizing interference with the capture of migratory fishes or free navigation or the right to use on any private ground any method or implement for the taking, growing or cultivation of shellfish.

SEC. 12. Entry takers shall make return to the Secretary of State of all franchises granted under this act in the same manner as provided in Section 2,776 of the Code, and the provisions of Sections 2,777 and 2,778 of the Code are hereby extended so as to cover the grants or franchises in grounds for raising or cultivating shellfish as authorized by this act, and all applications, grants, warrants and assignments of franchises in or to oyster grounds, shall be in manner and form as approved by the Attorney General of the State.

SEC. 13. All grants of grounds under previous acts for the purpose of cultivating shellfish in the territory within the provisions of this act are hereby confirmed and made good in the grantees, their heirs and assigns, provided the holders of said grounds shall, within one year, file with the Secretary of State certified copies of their licenses and surveys, and that the said surveys be found correct by the engineer of the commissioners of shellfisheries, and in case such surveys are said to be incorrect, the grounds shall be resurveyed by said engineer as soon as practicable, and in designating lots any person who has made in good faith an actual effort to raise or cultivate shellfish on the area for which application is made, shall have the prior right to a grant or franchise in said grounds; but nothing contained in the act shall be construed to validate any entry heretofore made of a natural bed.

SEC. 14. The Commissioners of Shellfisheries shall keep books of record, in which shall be recorded a full description of all grounds granted under the provisions of this act, and shall keep a map or maps upon which shall be shown the position and limits of all public and private grounds.

SEC. 15. Any person who shall steal or feloniously take, catch or capture, or carry away any shellfish from the bed or ground of another, shall be guilty of larceny and punished accordingly.

SEC. 16. All acts or parts of acts in conflict with the preceding sections are hereby repealed.

SEC. 17. This act shall take effect on and after the day after its ratification.

Ratified this, the 28th day of February, A. D., 1887.

SALMON IN THE HUDSON.

MR. MATHER said that most of the members were aware that he had been hatching and planting salmon in the Hudson on account of the U. S. Fish Commission; that these fish had reappeared on the third and fourth years after planting. The first deposit was made in the spring of 1882, and many had been taken last year, also some this season which had been recorded in the pages of *Forest and Stream* and other papers.

The following letter bearing upon this subject, had just been received from Hon. Franklin M. Danaher of Albany, a gentleman well known as taking great interest in the protection of game, and who is the counsellor for the Eastern New York Fish and Game Protective Association.

Judge Danaher writes as follows:

MR. FRED. MATHER, *Cold Spring Harbor, N. Y.*

MY DEAR SIR: A friend of mine, now in my office, tells me that he saw three small salmon (the largest estimated at six pounds) taken in a net yesterday above the dam at Troy, and near the lock which does not exceed one hundred feet above the dam. They evidently had come in this lock which had just been emptied. The fish were returned to the water. The information is reliable and I thought it would please you to know it. If they were true salmon? What do you think of it? He knows of others taken last week just below the dam.

YOURS, F. M. DANAHER.

MIGRATION OF LAKE SUPERIOR FISH.

BY W. D. TOMLIN.

THE whitefish of Lake Superior waters is prized for its edible qualities, and the increasing scarceness is causing much concern among those whose tastes incline toward this really fine fish for table use; already the supply is being drawn largely from Canadian waters and from Lake Winnipeg; year by year men engaged in fishing have seen their feeding grounds almost deserted and the numbers still diminishing, until at last to find a large whitefish in their nets is indeed a curiosity. The present season's fishing finds scarce any body of fish north of Ontonagan, Michigan.

The fishermen of Wisconsin and Minnesota are thus deprived of any chance of obtaining this fish, by the gradual desertion of the old spawning grounds. I have said gradual because the disappearance has been fluctuating; some years the catches were prolific, then growing scarcer.

In the memory of men living in Duluth to-day, whitefish could be seen in Sucker Bay, twenty years ago, so thickly crowding one another that the water seemed alive with them. A thousand barrels of whitefish could have been put up from this single spawning or feeding ground.

Captain Vose Palmer, an old fisherman who owns property on this Bay, states that twenty-five years ago, it was enough to send an enthusiast wild to see the immense quantities of fish come in on the swells until the waters were apparently a compact mass of fish.

Captain R. H. Palmer, a brother of Vose Palmer, who has fished Superior waters nearly thirty years, says that beginning at Sucker Bay or Stony Point, and following the north shore line eastward up to Thunder Bay, near the mouth of the many rivers and streams that come tumbling into Lake Superior, you could find the feeding grounds of the whitefish, and in the bays near to them millions of young whitefish could be seen in their season.

Captain Alex. McDougall, a lake captain, whose earlier years

were spent in fishing, has cruised in almost every bay, creek, river or stream in this end of Lake Superior, and has carefully noted the habits of the whitefish, and knew both their spawning grounds, and feeding grounds, and has seen the young fry of whitefish by the million along the shores both of Minnesota and Wisconsin. Captain McDougall has endeavored for years to call attention to the alarming decrease of whitefish and to find some remedy for the same.

With the demand for whitefish, and the opening up of towns in the great Northwest, larger areas of nets were spread, more men were employed in the business, steam tugs were employed to carry the fish to the trains that delivered the fish to the towns on the prairies of the West and beyond the Mississippi; then came the first notice of any spasmodic migration or variation of the schools of fish on their feeding grounds. It became so noticeable as the years rolled by that the most observant and intelligent fishermen counted the years. There came an immense glut of fish, markets were overstocked, the nets in the water were filled, and before the men could dispose of the first catch and get to their nets, the fish were dead and thus useless. That season much fish was destroyed, not by any carelessness, but by such immense schools coming into the nets that the men could not take care of them.

The year following the season's catch was a diminution of the usual catch; the next season was still smaller; the fourth season was almost a failure; these singular periods vary, sometimes coming every fourth or fifth year, and until the men ceased expecting catches of whitefish they almost knew about the proportion of whitefish they might expect. These facts are confirmed by Captain Martyn Wheeler and Captain Ed. S. Smith, both engaged in fishing for some years, as well as fishermen of other nationalities who have been fishing these waters for more than twenty years.

The fishermen were at one time prodigal of the fishing wealth of this inland sea; it was each for himself, and undoubtedly grew careless both of the manner of netting and the disposing of offal when cleaning the fish for the market. When the facts began to present themselves in fierce array, "that there was a possibility

of over-fishing Lake Superior," then the fishermen began to enlarge the size of the mesh of their nets, and to discontinue the use of the pound nets; and using only seine nets for their work, the size of meshes was increased from $3\frac{1}{2}$ in. to 4 in. Still finding their catches diminishing they inquired for causes; at this point the U. S. Fish Commission by some means had circulated along the chain of the Great Lakes the information that all offal dumped into the lake near to spawning grounds was injurious to spawn, and that both trout and whitefish would seek other grounds to spawn if fish offal was dumped into the lake.

One after another all the old grounds had been deserted until fishermen who went to Sucker Bay, twenty miles from Duluth, now have to go one hundred miles away, and then only get an occasional whitefish; while the fishing grounds proper lay in the body of the great lake, too far for fishermen at the eastern end of Lake Superior to reach them. It looked as if the fishermen had "killed the goose that laid the golden egg," not by any greed or gross carelessness, but by ignorance and inadvertence.

Many of them believe firmly that the coming of the schools of whitefish and lake trout are spasmodic, though they cannot assign causes for this. They think that after a season of unusual northeasterly gales succeeding spawning time the spawn is destroyed by a too violent agitation of the waters. And as Lake Superior eastern storms are often long continued and of destructive force, the next season's supply of young fry is very small in numbers. Another cause may be the careless dumping of fish offal on the feeding grounds, this causing the whitefish to seek new grounds until this substance is destroyed, and thus in three or four years the fish again return to the feeding grounds.

The fishermen of Lake Superior have learned that the whitefish is a very timid fish; that continued netting for two or three seasons will drive them to seek new grounds; and that once driven away it takes years for the schools to come to the same grounds again. The sentiment is increasing that the utmost care must be taken not to drive away the young fry that have been planted by the Minnesota Fish Commission, and are finding their way to feeding grounds that were fished ten years ago.

Duluth, Minn.

The subject of the time and place of the next annual meeting then came up for discussion. Mr. Spensley moved that the meeting be held in Detroit on the third Tuesday in May, 1888.

Dr. Cary moved to amend by substituting Washington for Detroit. A general discussion followed, in which the comparative merits of Washington, New York and other cities were discussed.

Mr. May thought that as Washington was the headquarters of the United States Fish Commission and the National Museum, where all articles and implements used in fish-culture could be seen, that it was the most interesting place in the country to hold the meeting; that there would be a better attendance, especially if Congress was in session, and that more valuable papers and discussions would come to the meeting there than at any other place.

Mr. Mather agreed with Mr. May, and said that as an original member, if not the founder of the Society, and speaking as one who had never missed a meeting since the first one in 1872, he could say that he had met with the Society at Albany, New York and Chicago; that it was his opinion that there were only two places that a good successful meeting could be held,—these were, as Mr. May has said, Washington, if Congress is in session at the time, and the second place was New York City; but as Michigan was strongly represented in the present meeting, and if in the judgment of the members the next meeting should be held at Detroit, he would pledge himself to attend it if possible, and do all in his power to make it a success.

Mr. Whittaker assured the members that he and his colleagues of the Michigan Fish Commission, would do everything in their power to make the meeting a success, and he felt assured that the Society would be well attended. The question was called on the amendment of Dr. Cary to meet in Washington, and was lost. The question on the original motion was then put and carried. It was resolved that the next meeting should be held in Detroit on the third Tuesday in May, 1888. Messrs. Whittaker, Mather and Bissell were appointed a committee to invite persons and papers for the next meeting.

A telegram from Treasurer Blackford was received, saying that he had been delayed by a press of business, but that his report had been forwarded by mail. On motion it was decided to accept his report, and the meeting adjourned.

The following is the report of the Treasurer for the last year.

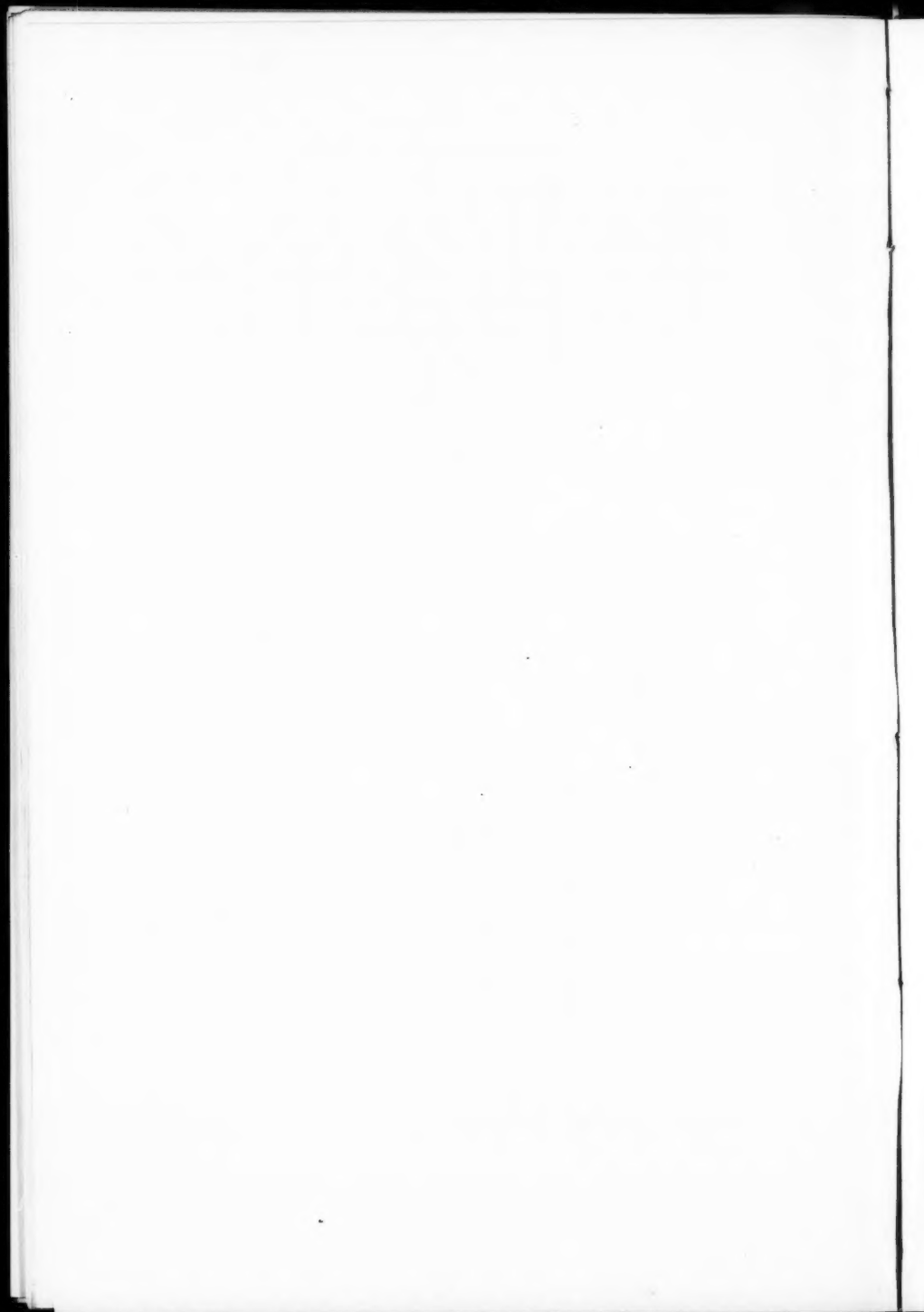
TREASURER'S REPORT.

Dr.

American Fisheries Society in Account with Eugene G. Blackford, Treasurer.

Cr.

1886.	To Cash balance in Treasury.	\$37 63	May 13th.	By Cash, F. Mather expenses at Chicago meeting.	\$2 20
April 29th.	To Cash amount received for Annual Dues to date,	90 00	"	By Cash, W. A. Butler, Jr. at Chicago meeting.	13 54
			Sept. 27th.	By Cash, to bill of Stenographer at Chicago meeting, and express on report to N. Y.	50 50
			Oct. 23rd.	By Cash, Postage Stamps and Wrappers.	5 43
			Dec. 31st.	By Cash, J. M. Davis, printing annual reports.	129 28
			1887.		
			May 6th.	By Cash, Postage Stamps and Wrappers.	2 55
			" 30th.	By Cash, F. Mather, Bill of Telegram, &c.	4 30
	Balance due Treasurer,	\$80 17			
		207 80			\$207 80



MEMBERS

OF THE

AMERICAN FISHERIES SOCIETY.

HONORARY MEMBERS.

- H. R. H., the Crown Prince of Germany.
Behr, E. von, Schmoldow, Germany; President of the Deutschen Fischerei Verein.
Borne, Max von dem, Berneuchen, Germany.
Huxley, Prof. Thomas H., London; President of the Royal Society.
Jones, John D., 51 Wall Street, New York.

CORRESPONDING MEMBERS.

- Apostolides, Prof. Nicolay Chr., Athens, Greece.
Buch, Dr. S. A., Christiana, Norway; Government Inspector of Fisheries.
Birkbeck, Edward, Esq., M. P., London England.
Benecke, Prof. B., Königsberg, Germany; Commissioner of Fisheries.
Brady, Thomas F., Esq., Dublin Castle, Dublin, Ireland; Inspector of Fisheries for Ireland.
Chambers, Oldham, W. Esq., Secretary of the National Fish Culture Association, South Kensington, London.

- Day, Dr. Francis, F. L. S., Kenilworth House, Cheltenham, England; late Inspector General of Fisheries for India.
- Feddersen, Arthur, Viborg, Denmark.
- Giglioli, Prof. H. H., Florence, Italy.
- Hubrecht, Prof. A. A. W., Utrecht, Holland, Member of the Dutch Fisheries Commission, and Director of the Netherlands Zoological Station.
- K. Ito, Esq., Hokkaido Cho., Sapporo, Japan, member of the Fisheries Department of Hokkaido, and President of the Fisheries Society of Northern Japan.
- Juel, Capt. N., R. N., Bergen, Norway; President of the Society for the Development of Norwegian Fisheries.
- Landmark, S., Bergen, Norway; Inspector of Norwegian Fresh-water Fisheries.
- Lauderdale, the Earl of, Stirling, Scotland.
- Lundberg, Dr. Rudolf, Stockholm, Sweden; Inspector of Fisheries.
- Marston, R. B., Esq., London, England; Editor of the *Fishing Gazette*.
- Macleay, William, Sydney, N. S. W.; President of the Fisheries Commission of New South Wales.
- Sars, Prof. G. O., Christiania, Norway; Government-Inspector of Fisheries.
- Solsky, Baron N. de, St. Petersburg, Russia; Director of the Imperial Agricultural Museum.
- Sola, Don Francisco, Garcia, Madrid, Spain; Secretary of the Spanish Fisheries Society.
- Wattel, M. Raveret, Paris, France; Secretary of the Société d'Acclimation.
- Young, Archibald, Esq., Edinburgh, Scotland; H. M. Inspector of Salmon Fisheries.
- Walpole, Hon. Spencer, Governor of the Isle of Man.

DECEASED MEMBERS.

- | | |
|-------------------------|--------------------|
| Baird, Hon. Spencer F. | McGovern, H. D. |
| Carman, G. | Parker, W. R. |
| Chappel, George. | Redding, B. B. |
| Develin, John E. | Redding, George H. |
| Garlick, Dr. Theodatus. | Rice, Prof. H. J. |
| Lawrence, Alfred N. | Smith, Greene. |
| Shultz, Theodore. | |

MEMBERS.

Persons elected at last meeting and who did not pay their dues do not appear in this list.

Adams, Dr. S. C., Peoria, Illinois.
Agnew, John T., 284 Front Street, New York.
Anderson, A. A., Bloomsbury, N. J.
Annin, James, Jr., Caledonia, N. Y.
Atkins, Charles G., Bucksport, Maine.
Atwater, Prof. W. O., Middletown, Conn.
Bailey, W. E., U. S. Fish Commission.
Banks, Charles, 453 Fifth Avenue, New York.
Barrett, Charles, Grafton, Vermont.
Bartlett, S. P., Quincy, Illinois.
Bean, Dr. Tarleton H., National Museum, Washington, D. C.
Belmont, Perry, 19 Nassau Street, New York.
Benjamin, Pulaski, Fulton Market, New York.
Berkard, James, Union Club, New York.
Bickmore, Prof. A. S., American Museum, New York.
Bissell, J. H., Detroit, Michigan.
Blackford, E. G., Fulton Market, New York.
Booth, A., Chicago, Illinois.
Bottemane, C. J., Bergen-op-Zoom, Holland.
Brown, J. E., U. S. Fish Commission.
Brown, S. C., National Museum, Washington, D. C.
Bryan, Edward H., Smithsonian Institution.
Bryson, Col. M. A., 903 Sixth Avenue, New York.
Butler, W. A., Jr. Detroit, Michigan.
Butler, Frank A., 291 Broadway, New York.
Butler, W. H., 291 Broadway, New York.
Carey, Dr. H. H., Atlanta, Ga.
Cheney, A. Nelson, Glen Falls, N. Y.
Clapp, A. T., Sunbury, Pa.
Clark, Frank N., Northville, Mich.
Clark, A. Howard, National Museum, Washington, D. C.
Comstock, Oscar, Fulton Market, New York.
Conklin, William A., Central Park, New York.
Conselyea, Andrew, Springfield, Long Island, N. Y.
Cox, W. V., National Museum, Washington, D. C.
Crook, Abel, 99 Nassau Street, New York.
Crosby, Henry F., 18 Cliff Street, New York.
Dewey, J. N., Toledo, Ohio.

Dieckerman, George H., New Hampton, N. H.
Donaldson, Hon. Thomas, Philadelphia, Pa.
Dunning, Philo, Madison, Wis.

Earll, R. E., National Museum, Washington, D. C.
Ellis, J. F., U. S. Fish Commission.
Endicott, Francis, 57 Beekman Street, New York.
Evarts, Charles B., Windsor, Vt.

Fairbank, N. K., Chicago, Ill.
Ferguson, T. B., U. S. Fish Commission.
Foord, John, Brooklyn, N. Y.
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